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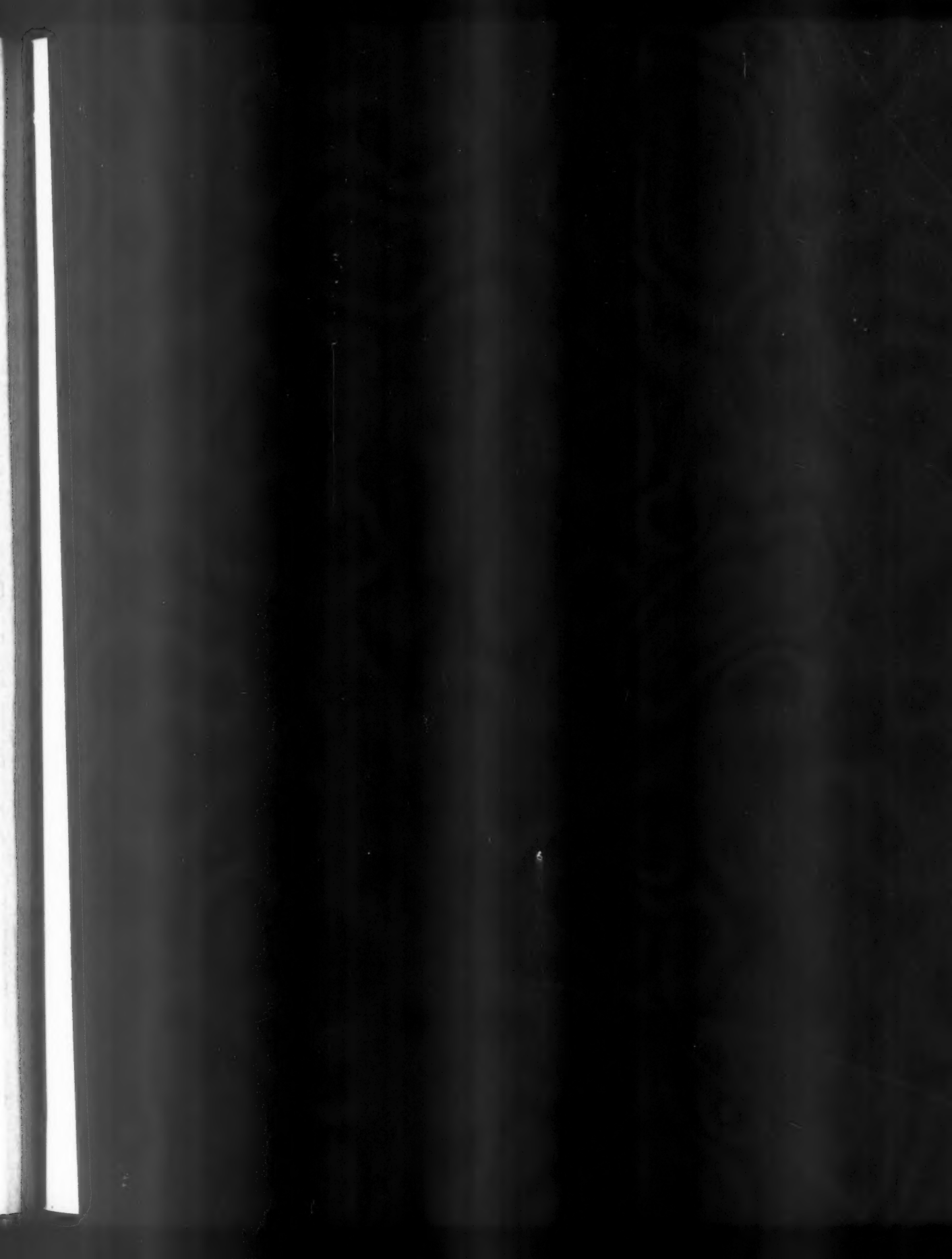


Municipal Engineering

VOLUME XXI. NOVEMBER, NINETEEN HUNDRED ONE. NUMBER 5.

THE IMPROVEMENT OF CITIES.

The eighth annual convention of the American Society of Municipal Improvements at Niagara Falls, October 2 to 4, was one of the most successful meetings the society has ever held in the way of value of papers presented and practical benefit of the discussions. The attendance was small and was made up of those who are most intensely interested in the improvement of their methods, and are looking most earnestly for new light upon the important problems in their departments.

The society is made up largely of municipal officials connected with the departments having the material improvement of municipalities in charge, including mayors, councilmen, boards of public works, water, sewer and light commissioners and superintendents, city engineers and the engineers of various boards. All of these have more or less uncertain tenure of office, those in the latter part of the list being more nearly permanent than the others. As a consequence the membership from many cities changes largely from year to year, and cities most closely identified with the work of the society one year may have no representation the next. Much work must therefore be done by the officers of the society in developing interest in its work in the cities already members as well as in other cities if the attendance is to be increased. Whether enough of this work has not been done in the past or it has not been well directed, the society now proposes to extend the knowledge of its value, with the expectation that this will result in more widespread interest in its work.

A new secretary, like a new broom, may be able to sweep clean. Certainly those who read the papers which we present with this report of the proceedings need no further evidence of the benefit of the meetings, except the statement that the personal contact with the members and the participation in the discussions is equally valuable. A little experience will demonstrate the truth of this assertion, and this experience will be easily obtained by joining the society and attending its next meeting at Rochester. The admission of engineers and others to some class of membership in the society, independently of their connection with municipal offices, will tend toward the permanence of membership which is desirable in order to have uniformly large attendance at the conventions.

The peculiar arrangement of the program kept the members, except those directly engaged, from trying to reach the city in time for the first day's session. The possibility of four sessions on four different days also doubtless kept some busy members from trying to guess upon which day the papers in which they were interested would be presented, it being evidently impossible to present them all in the single session of the second day for which they were apparently scheduled. So many members are unable to spend the whole time of the convention away from their work that a division of the program into sections is best because it enables such persons to select the day for their attendance, and thus the member can get the benefit of the discussions and the society can get the benefit of the knowledge of many who do not otherwise appear.

Actually the program was carried out in the manner in which the society usually conducts its conventions and the four sessions, instead of being spread over four days, were held consecutively, beginning Wednesday morning, so that the business of the convention was completed by Thursday noon, leaving the rest of Thursday and Friday for the excursions to manufacturing plants, so courteously offered, to the exposition and to the points of scenic interest. The announcement of the program in the form in which it was carried out would have been of benefit to the attendance.

The day sessions were held in the audi-

torium of the Natural Food Company and the evening session in the Convention room of the International Hotel. The society dedicated the former, which has been designed for lectures and as a convention hall.

Mayor M. B. Butler welcomed the convention to the city and presented its advantages as a manufacturing and residence city, in a few well chosen and earnest words. President R. E. McMath responded and followed with the annual address, from which the following extracts are made:

PRESIDENT'S ADDRESS.

By Robert E. McMath, St. Louis, Mo.

The society holds its eighth annual convention near, but not at, the city where it was organized in 1894, therefore it is not inappropriate to say that the society has completed its first cycle, a septad. The society has shown that it is an organization which knows no territorial limitations, for our membership contains names of cities and men widely separated in longitude and latitude. The society has met at Buffalo, Cincinnati, Chicago, Nashville, Washington, Toronto, Milwaukee and now at Niagara Falls.

At all of these cities we have been welcomed and cared for; we have received and hope we have conferred good at each city visited. We have met representative people and have seen the cities, their public works, buildings, institutions, industries and homes.

Since the organization of this society, which can justly claim to be the pioneer organization in the municipal field, other societies having objects akin, but not the same, relating to the conduct of municipal affairs, have been formed.

They have undertaken the discussion of important questions of municipal policies and management. I see no reason to deprecate the multiplication of agencies so long as each finds and occupies its own particular field of work.

This society from its first organization has aimed to be practical rather than speculative or theoretical, to deal with details of municipal administration rather than discuss forms of general organization or the principles underlying municipal policies. Our convention attendance is largely by the men who do things, often with inadequate means or support. Men whose desire is to learn how to do better.

The papers and discussions have nearly all related to works done or proposed, how to do them, to the physical needs of cities, their business methods and comparative facts.

The object of the society, as expressed by its constitution, is "To disseminate information and experience upon and to promote the best methods to be employed in the management of municipal departments and in the construction of municipal works," by means of annual conventions, papers and discussions, by social intercourse, and to circulate by means of an annual publication the information thus obtained.

During the existence of the society we have had on:

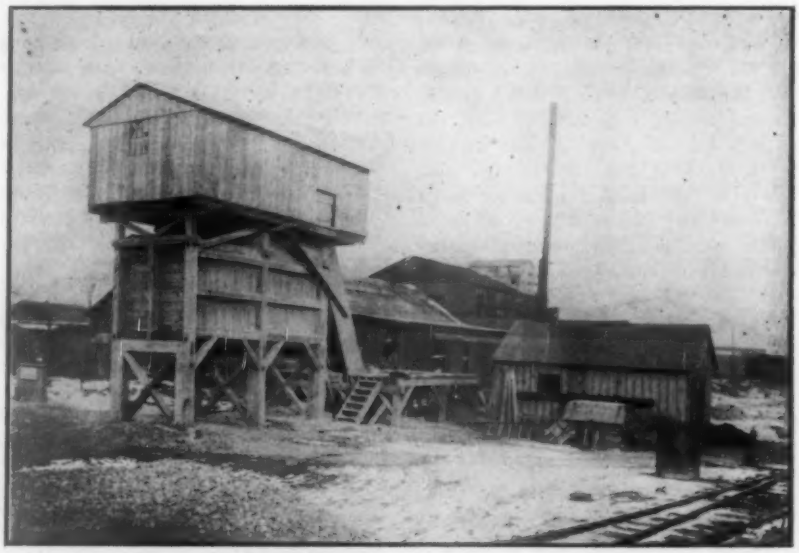
Street Paving and related topics	41	papers	and	reports
Street Lighting	7	"	"	"
Sewerage and Sanitation	18	"	"	"
Water Works and Water Supply	17	"	"	"
Taxation and Assessment	8	"	"	"
City Government and Legislation	5	"	"	"
Disposition of Garbage and Sanitation	14	"	"	"
Municipal Franchises	1			"
Review of Progress	3			"
Municipal Data and Statistics	4			"
Park Development and Maintenance	4	"	"	"
Coating Water Pipe	4	"	"	"
Electrolysis	6	"	"	"
Grade Crossings	1			"
A total of	133	"	"	"

This statement does not include the papers and reports expected at this convention. Only one paper was presented at the first convention, hence the statement really covers the work of six conventons. Reviewing the proceedings, papers and discussions, the entire absence of politics, controversy and the advocacy of methods or materials in the interest of contractors for work, materials or appliances is noteworthy.

To one seeking information the papers and discussions contain much of value and every city should have a complete set of our proceedings for the use of present and future officials.

The foregoing review of the work of the society is appropriate to this occasion, as showing that this society has found its legitimate field for work and that we have worked in that field.

Following a suggestion made at the Milwaukee convention that combination or co-operation of different organizations would be helpful to the ends sought by all, an overture was made to the National Municipal League suggesting that a common time and place for this year's meetings of the League and this Society be arranged. After some correspondence an invitation was extended for a member of this Society to explain our objects and work at the meeting of the League at Rochester. This was done and the matter rests. If the Society desires to make further effort I suggest that the proposition be for a common date and place in 1903. It is certain that all of the organizations will be invited to meet at St. Louis that year and if all accept one step will have been gained—a common place. Personally I doubt the advisability of consolidation, but close affiliation would certainly be advantageous to all.



MUNICIPAL STONE CRUSHING PLANT, GENEVA, N. Y.

It is a common experience of city officers that their attention is largely given to matters of detail and routine which are not stimulating to mental activity. If an official has ambition to accomplish something beyond mere routine his motion often fails to receive a second. He finds that limitations abound and that opportunities to take forward steps are few. Conservatism and inertia are often opposing forces and the rock of narrow means has shattered many an ambitious project in spite of its obvious merits. As a means of keeping up one's courage it is a good thing to go from home, and see what is done in other cities, to meet and exchange experiences with others who encounter like conditions and learn how to overcome difficulties or to yield with good grace when they are insurmountable.

In some lines of business seemingly the most successful man is he who rides roughshod over opponents and competitors, who consults his lawyer not to obtain an opinion as to the legality or justice of a proposed course, but how it can be done without incurring penalty. The city officer cannot ride roughshod nor can he count on immunity if he exceeds his powers. The municipal officer who thinks and plans beyond the necessities of the time does so without the stimulus of expected reward or even credit. If he departs from the old ways and tries to secure better results; if from a sense of duty he opposes some scheme, such as a franchise or contract whose advantage is wholly one-sided, or an improvement which is out of time or which will serve a private or sectional interest, or if from like sense of duty he urges an improvement or mode of doing work which is in advance of the wishes of reluctant tax-payers, not in the line desired by contractors or not in accord with precedents

and local prejudices, he will find active opponents and lukewarm supporters.

Regarded in this light it is little wonder that many fall into a listless discharge of their functions. As a corrective of such a tendency membership in this society and attendance on its meetings is of value.

Under our American practice of frequent elections, short term appointments and changes of officers on political grounds, the city official is liable to be relegated to private life, then of necessity he must interest himself in other lines of study and labor, and in a short time ceases to take more than general interest in municipal affairs. In consequence we miss familiar faces at our conventions and the society loses valuable members. After announcing the committees provided to carry on the work of the society your president receives numerous pleas for excuse from serving, on the ground that having ceased to be city officials, and having entered into other business engagements, they cannot give the requisite time and study to the subject assigned them. We miss at this convention, as at those previously held, men who worked heartily with us and were always ready to give information or who enlivened our proceedings by asking questions. One year ago the society wisely eliminated from its constitution a provision which practically excluded from full membership the ex-official unless he was an engineer. Under the present provisions we may hope to retain the old members and gain their official successors as new. While for general reasons the frequency of changes it to be regretted, as a society we welcome the new officials to membership and hope to do them good and to receive good of them. It is the wish of your retiring president that his successor may receive fewer requests to be excused from committee work because of change in conditions than has been his lot.

Our society undertakes to deal with the material section of the municipal field; that is, the management of municipal departments. Sanitation, construction and maintenance of municipal works, keeping cities clean, providing means of recreation and making them beautiful. When these functions are well performed a reflex influence will extend to the esthetic and moral parts of the field.

As cities progress in commerce and manufactures they increase in population and the need for material municipal improvements increases in a geometrical ratio as the city grows in this respect. The same kind of ratio applies to the character of improvements, as well as to their number, scale and extent. What is suitable in a village or small city would be inappropriate in a large one. Improvements suited to the commercial center of a large city are not adapted to parts of the same city occupied by manufacturing industries. Residence sections must be treated differently from business sections and all residence sections cannot be treated alike. It is not wise for a city to adopt hard and fast rules as to width of streets or of the roadways thereof, whether alleys shall be provided in all cases or as to the kind of material used for pavements. It should also be kept in mind that changes occur whereby business invades residence sections and that suburban places are subdivided into lots and will be built up solid. Every city has seen more or less pretentious mansions becoming boarding houses, then tenements, next transformed into shops, and finally torn down to make place for a business building, which in its turn passes through stages of change. Considered as investments it does not pay to build or improve property except with reference to an immediate and rather short future. The same is in a partial sense true as to public municipal improvements. It is the duty of city officials, therefore, to make careful study of conditions and endeavor not to burden today with costly improvements for the supposed benefit of an uncertain future and not to impose on posterity interest and principal charges for works whose usefulness will have departed but the charges continue. On the other hand, the present should not be made to suffer for want of improvements because future developments may find the best that is possible now inadequate ten or twenty years hence. Improvements should in many cases be made in the expectation of a limited term of use. These remarks apply to street improvements, sewers, water supply and public buildings, but of course not in equal measure. Such improvements are commonly classed as permanent and are often paid for by the issue of bonds, on the plea that posterity should pay for what it will have unimpaired use of. The essence of the proposition in each case is, will the use be unimpaired for the full term for which the charges will continue? I speak of these matters because many cities suffer from debt burdens incurred under a mistaken policy on the part of those who have preceded us.

The administration of most American cities is open to much criticism for bad methods or want of method, and many

think that the influence of political parties upon city affairs is a main cause of unsatisfactory conditions, and it is often said that city administrations should be conducted on business principles and according to business methods. What is meant by the term business in this connection? If it is meant that city affairs should be conducted on correct principles and methods adapted to city business, then the proposition is good beyond all question, but if the thought is that cities can or ought to adopt the principles which prevail in private or corporate business or to follow the methods which are used by those whose main purpose is to make money the proposition is wrong fundamentally.

By far the larger part of a city's expenditure is for purposes which are temporary, payment for services which are useful and needed, but which leave no result—salaries of officers and clerks, fire departments, police, courts, jails, hospitals, cleaning and maintaining streets, sewers and public offices and the like. Hence the province of a city is to spend money, not to make it. Th only return for money spent is the public weal for the time, and the need for fresh expenditure is undiminished. In business, as commonly understood, money is used to obtain a future return which will eventually replace the money expended with a profit added. This is a radical difference.

City administration is in many respects parallel to that of the home, and hence it would be more appropriate to look for models and principles among housekeepers than among managers of profit-seeking business.

In the speaker's view cities suffer much from bad business principles and methods derived from private and corporate models. A "clique" may run a corporation, and a "ring" run a city. A syndicate may secure control of corporations, a Tammany may do the same in politics. The discontent of stockholders in the one case will be strikingly parallel to that of taxpayers in the other. Perhaps it may be equally consoling to stockholders and taxpayers to be told the remedy is in your own hands, elect men to office who will look after your interests in preference to their own. The difficulty and its remedy lie outside the province of this society, though the consequences greatly affect the work of our members.

The Committee upon Uniform Municipal Accounting and National Statistics, Charles Carroll Brown, chairman, presented a report recommending that action upon the former reports of the committee be deferred until the forms for the municipal accounts of Chicago are published, as these are likely to be models for other cities. Appendices to the report showed the progress that has been made in the discussion of the subject.

The Committee on Proper Construction and Maintenance of Brick Pavements reported failure as yet to agree upon a recommendation regarding specifications for brick pavements, but stepped outside its strict duty to recommend the acceptance by the society of the standard method of making rattler tests of brick. After considerable discussion, which seemed to be necessary to clear up the ideas of the members upon the subject, the report of the committee was concurred in.

The report of the committee presented the following history of the rattler test and description of the present proposed standard method of making it:

REPORT OF THE SPECIAL COMMITTEE ON UNIFORMITY IN MUNICIPAL ACCOUNTING AND ON NATIONAL STATISTICS.

Charles Carroll Brown, Chairman, Indianapolis, Ind.

The Committee on Uniformity in Municipal Accounting and on National Statistics desires to present a report of progress and to file with its report a series of appendices which will give statements of what has been done, which will aid the work in which this committee is engaged. Some effort has been made during the year to secure some concert of action among the various societies interested in the subject, but thus far without much evidence of success.

The Committee on Municipal Accounting and Statistics of the American Municipal League, feeling that that society occupied a sort of central position, has attempted to assume the lead in the effort to secure the desired concert of action and tried to bring about a conference of committees upon the subject of connection with the last meeting of the league. The attendance was very light, but an interesting discussion is reported. Your chairman was detained almost at the last moment by

business which could not be postponed and was therefore unable to be present. At the meeting of the league the committee presented in a report a proposed form for the unifying of municipal department accounts and a report for the city of Newton, Mass., prepared in conformity with this form. The city auditor of Newton would doubtless respond to requests for this report. The committee has in its membership Edward M. Hartwell, chairman statistics department, city hall, Boston, Mass.; Harvey S. Chase, Boston; M. N. Baker, St. Paul building, New York. Mr. Hartwell states that there will be four schedules for various sizes of cities, A, B, C and D. The Newton report is based on schedule D. When all the schedules are finally determined upon he proposes to apply them to the account of cities of Boston, Mass.; Providence, R. I.; Rochester, N. Y., and Newton, Mass., and make the result one of the special publications of his department.

The New England Water Works Association has a joint conference committee consisting of Joseph E. Beals, Middleboro, Mass.; J. C. Whitney, Newton, Mass.; George F. Chase, Taunton, Mass. This committee is carefully considering the subject and may have something in its line to report at the meeting of the association this fall. This association has long had a valuable summary report for water works systems which is the only adopted form in actual use. The form is given in Appendix B.

The American Water Works Association in June appointed a committee on water works statistics, reports and accounts, consisting of Dow R. Gwinn, President Water Co., Terre Haute, Ind.; John C. Trautwine, jr., 257 S. Fourth-st., Philadelphia, and Emil Kuichling, Rochester, N. Y. This is a remarkably well equipped committee and most valuable assistance should be expected from them. This society has not heretofore taken any formal action in this line.

The National Electric Light Association has a committee on a uniform system of accounts which has prepared a general plan of classification of income, construction and other expenditures, and a list of accounts under each classification, naming enough items under each heading to show the character of the items belonging to it. This appears in Appendix C. Chas. E. Tripp, P. O. Square, Boston, Mass. was chairman of the committee making the report.

A number of examples of actual accounting forms of electric light stations were published in Muncipal Engineering in 1899 and 1900. The ease with which the uniform system can be applied can be judged by comparing these forms with Appendix C.

The American Public Health Association has a committee on demography and statistics which is seeking "to bring about uniform practice in the classification of causes of death, and has had considerable influence among the registration offices of the country. The needs of localities in this country are so various we can hope for nothing better than conformity to a general scheme."

The American Society of Civil Engineers has a committee on census of municipal work, of which S. Whinery, 95 Liberty-st., New York, is chairman, whose duties do not include a consideration of the subject of uniform accounting. The board of direction has not seen fit to appoint a committee upon the latter subject although it has been strongly recommended to them.

W. A. Veach, Newark, O., is chairman of a similar committee of the Central Water Works Association, Mr. A. C. Humphreys, Nassau-st., New York, of the American Gas Light Association and Wm. M. Cole, Fall River, Mass. of the American Statistical Association. No word has been received from these three committees and it is assured that they have nothing to report as yet.

Object lessons of the value of full reports of all municipal operations will be found in monthly and special bulletins of the departments of statistics of Boston and Chicago. The former is now in its third year and the latter is in its first. Samples of the monthly bulletins can be obtained from the departments of statistics of the two cities, also on particular subjects by addressing the superintendents of the departments.

A special committee of the League of California Municipalities with the secretary, H. A. Mason, Mills building, San Francisco, Cal., prepared a special account book, copied from the book introduced in Oakland by Auditor Snow for the purpose of segregating municipal expenditures. This book is furnished by the secretary at cost to cities desiring it, and about fifteen are now in use, in cities ranging in size from Oakland (66,000) to Santa Clara (4,000), showing the adaptability of the blank book to the varying needs of larger and smaller cities. Copies of the book can be obtained at $3.00 postpaid. They have done much to secure uniformity in the reports of California cities. Unfortunately many of the

cities do not print their reports. The auditors of Oakland and Pasadena will doubtless send copies of their reports to the officials of other cities, which give the totals from the form and thus give a good idea of its method of use.

The most elaborate form for reports is one a sketch of which is presented in Appendix D. This is issued by a company owning a large number of water works in various parts of the country and is filled out weekly and transmitted to the central office monthly. This form is much more elaborate than this committee has thought it desirable to recommend in the past, but

LINDEN STREET, GENEVA, N. Y., WITH ASPHALT PAVEMENT.

was used as a guide in formulating some parts of forms recommended.

Attention is called to the report of the municipal commission of Herkimer, N. Y., a village of 5,600 inhabitants, as an example of what can be done when business principles are applied to municipal accounts. With as full reports as this and as carefully separated accounts, there would be little difficulty in securing uniformity.

The forms used by the United States Department of Labor, Carroll D. Wright, commissioner, in securing the information for its fourteenth annual report, containing nearly 1,000 closely printed pages of tabulated data and comment thereon concerning water, gas and electric lights, should have special notice.

The form used in reporting cost of pumping water in the report of the committee on water works of the Illinois Society of Engineers and Surveyors, printed on the 14th and 15th annual reports of the society for 1899 and 1900 may also be mentioned.

A periodical devoted to electricity is printing a series of "Wrinkles" as supplements to its monthly numbers. Wrinkle No. 6 is a form of loose leaf account sheet segregating the accounts of gas and electric light works. See Appendix E.

Municipal Engineering Company, Indianapolis, issues the "American Water Works Standard Bookkeeping System," a series of books for keeping the accounts of water companies, and has supplied a number of offices with them. Prices depend upon size of books and forms of binding. Examples of their use and explanations are given in Appendix F.

"Municipal Accounting, a Comprehensive Treatise on the Subject of Municipal Accounts, Illustrated by Specimens of Improved Forms of Books and Reports," is the title of a book by F. H. Macpherson, C. A., Windsor, Ont., a member of the Institute of Chartered Accountants of Ontario, which has just been issued by the Bookkeeper Publising Company, Limited, of Detroit. This book goes with some detail into all the various accounts and forms of reports, showing headings of columns and methods of making entries, form of balance sheet, forms of special register and record books.

warrants and checks, etc. See Appendix G. for a copy of the municipal balance sheet giving the analysis and classification of accounts.

The last Illinois legislature passed a bill requiring the state auditor of public accounts to formulate and prescribe uniform systems of accounting and reporting for all public offices, and representing what the accounts should show, providing for separate accounts of each department and for each appropriation, and for each public service industry. The state auditor was given power to examine the accounts of each officer and was required to make certificate of the correctness of his accounts before his bondsmen could be released. The governor vetoed the bill because it changed the date of ending the fiscal year; because it delegated the power to formulate the system to the auditor; because it required every officer of every grade in the state to report to the state auditor, and the auditor to publish an annual volume of summarized detailed comparative statistics, for which a large and expensive force would be required; because the auditor had too much power and too close supervision of local methods of doing business including the release of bondsmen; because its title was not comprehensive enough to include all its features. The bill seems to have had a fault which reform bills are likely to have, that of attempting a complete system, and failed, partly because no complete system for so large an undertaking could be formulated in one bill in which serious errors and omissions could not be found, partly because such a system interferes with the opportunity of too many users of public office for private gain, and partly because so radical a change is seriously objectionable to the solid conservative body to which we must look for the stability of our forms of government and the checking of the speed of the radical reformer whose complete success might well put us in worse condition than the present. See Appendix H. for a copy of the bill and veto.

Mr. Harvey S. Chase of Boston presented a valuable paper on the practical applications of uniform accounting to city comptroller's reports to the last meeting of the National Municipal League, in which he analyzed the plan of the schedule presented by the committee of which he is a member, the work of which is stated above. He states that he is consulting expert to a firm of public accountants, Haskins & Sells, who are now engaged in preparing a system of accounts for the city of Chicago, including all the city departments, which has the same basic principles.

Your committee makes the same recommendations as last year, viz.: that the agitation of the subject be continued and a committee with the same duties as this be again appointed. The development of so many practical attempts at uniformity during the past year or two is evidence of the rapidly increasing interest in the subject. The completion of the first scientifically constructed system of accounts, that of Chicago, will undoubtedly mark the starting point of successful effort in securing uniformity of accounts, and this is the only permanent way to secure uniformity in reports. It may be well to postpone definite action upon the particular forms of report in which the members of this society are interested until this system is published. Any additions which may be needed for our purposes can then be made in conformity with what will probably be the model after which all other systems will be formed.

Our own forms are added to this report in Appendix A. Doubtless there are others that are well deserving of notice, but they have not come to our knowledge.

REPORT OF SPECIAL COMMITTEE ON PROPER CONSTRUCTION AND MAINTENANCE OF BRICK PAVEMENTS.

Prof. A. N. Talbot, Chairman, Urbana, Ill.

At the Milwaukee meeting of this society, in response to a communication from the National Brick Manufacturers' Association, it was voted to constitute a committee on proper construction and maintenance of brick pavements to co-operate with a committee of the National Brick Manufacturers' Association. In the discussion at that time it was set forth that an investigation of the proper methods of constructing and maintaining brick pavements would be of service to the municipalities of the country and that such action would in no wise supersede the services of the engineer in making specifications to meet the requirements and conditions of individual municipalities.

In the deliberations of the committee it

has been somewhat difficult to determine the limits of the field of inquiry and to decide how explicit the report should be made. As the committee of the N. B. M. A. seemed desirous of formulating specifications, it was soon seen that the work of making a report which should cover ground acceptable to both societies would be more difficult than was anticipated, and it became apparent that more time will be necessary to discuss both the limitations of the field of the committee and the subject matter itself. The joint meeting of the committees and the correspondence before and after have been productive of a considerable amount of information, but your committee feels that the publication of this matter at the present time would be premature. The committee therefore desires to report progress. It further desires to report a recommendation on the method of conducting the test of paving brick known as the rattler test.

It may be well here to review some of the steps taken to secure a uniform method of testing brick. In 1897 the N. B. M. A., after a considerable investigation by its Committee on Technical Investigation, adopted a standard size of rattler and also voted to use brick alone in the cylinder as abrasive material. Various experimenters criticised this method as not certain to distinguish soft and brittle brick and considerable dissatisfaction arose in several cities where this method has been adopted. The Committee on Technical Investigation finally made a new investigation and in January, 1900, a special committee of the association, aided by several outside investigators of the testing problem, reviewed all data available and decided to recommend that the standard method be amended by striking out the provision requiring the use of brick alone in the rattler and substituting a standard charge of cast iron shot of two sizes together with twelve paving bricks or nine paving blocks. They also recommended an investigation of some modified form of the Jones rattler, a machine which held the bricks clamped in pockets around the circumference, but which failed to provide fair modifications for different sizes of brick. The association adopted the recommendation of the committee in February, 1900, and thus the present N. B. M. A. standard method of making the rattler test was formulated.

Aug. 1, 1901, the Committee on Technical Investigation of the N. B. M. A. met at Columbus, O., to consider the results of the investigation of Prof. Orton on the comparative action of the Standard rattler method and that of a new machine. The N. B. M. A. called to the conference several men interested in the testing of paving brick. Among them were two of the members of your committee. The new machine investigated was called by Prof. Orton the Talbot-Jones rattler. This machine is devised so that the brick are held in position around the periphery of a many-sided polygon, the brick themselves forming the cylinder which takes the blows of the cast iron shot used as abrasive material. In this respect the test approaches more nearly the conditions obtaining in the street and the wear is upon one face. The data presented by Prof. Orton included tests on two or three grades each of five makes of paving brick, both by the N. B. M. A. standard method and by the Talbot-Jones machine—altogether an elaborate set of tests.

This advisory committee, consisting of Dr. J. B. Johnson of University of Wisconsin, Prof. A. N. Talbot of University of Illinois, Prof. W. K. Hatt of Purdue university, Prof. Anton Marston of Iowa State College and Prof. Edward Orton of Ohio State University made a report of their findings to the Committee on Technical Investigation. They found that the Talbot-Jones machine overcame the mechanical defects of the Jones machine and is an efficient tool for testing paving brick, and that it discriminates more sharply between hard and soft brick than does the ordinary rattler, though the same general conclusions were reached by both processes. They considered that the Talbot-Jones machine is more complicated, more difficult to operate and somewhat more expensive, and that the advantages of the process are not sufficient to warrant a change from the simpler method already in use. They concluded that the 1900 N. B. M. A. standard method of making the rattler test is reasonably adequate and satisfactory as a rattler test and recommended a continuance of this standard. This finding was agreed to by other engineers present. While no report has been formulated by the committee of the N. B. M. A., your committee is informed that their report will be in accord with the above recommendation. Your committee is of the opinion that the rattler forms the best method of making an abrasive test of paving brick now available, and that the method adopted by the N. B. M. A. is fairly efficient so far as a rattler test can be made. The rat-

tler test has fallen into disfavor in many places because of the diverse results which have come from failure to carry out the same conditions in testing—shot, charge, speed, moisture and form of rattler. At best the great lack of uniformity in brick coming from the same lot is likely to make the results of the tests appear discordant.

For these reasons it is of great importance that the conditions for testing be prescribed and that these conditions be fully complied with. Furthermore, uniformity of practice will enable proper comparison of results obtained in different cities. So far as present information goes, the 1900 standard of the N. B. M. A. is fairly efficient for a rattler test, and its adoption would serve to advance the cause of improved brick pavement.

In view of the importance of uniformity of methods of testing, the committee presents the following requirements for a standard method of making the rattler test and advises that the society go on record as recommending the acceptance of these requirements as a standard for the rattler test of paving brick. The statement which follows varies from the wording of the N. B. M. A., but the meaning is substantially the same.

1. Standard Rattler. The standard rattler shall be polygonal in cross section, with 14 plane staves spaced one-fourth inch apart at their edges, and the interior shall be free from projections, offsets, roughnesses or obstructions. Rattlers having two staves more or less than the standard number may be used. The internal dimensions shall be 28 inches in diameter and 20 inches in length.

2. Standard Shot. A mixture of two sizes of shot will be used. The larger size will be about 2½ inches square and 4½ long and will weigh about 7½ pounds. The smaller size will be 1½ inches in each direction and will weigh about ⅞-pound. The shot shall be made of ordinary machinery cast iron, and all edges shall be made rounded to a radius of about ¼ inch. The individual shot shall be replaced by new pieces whenever they shall have lost one-tenth of their original weight. For the standard size of rattler the standard size of charge shall consist of 75 pounds of large shot and 225 pounds of small shot.

3. Number and Condition of Brick. For the standard size of rattler, twelve paving bricks or nine paving blocks will constitute the number to be used in a single test, but two more or less than this number may be used. The bricks shall be thoroughly dried before testing.

4. The Test. The rattler shall be rotated at a rate of not less than twenty-eight nor more than thirty revolutions per minute, and 1,800 revolutions shall constitute the standard test. The speed requirement is important.

5. The Results. The loss shall be calculated in percentages of the original weight of the dry brick composing the charge. In weighing the rattled brick any piece weighing less than one-half pound shall be rejected. Because of the variation in the brick and the chance for accidental variation in testing, tests shall be made in duplicate, and the average of the two tests shall be considered the official result.

6. Variations in Size of Rattler. Rattlers 28 inches in diameter and of a length greater than 20 inches may be used, in which case the charge of shot and the number of brick shall be increased proportionally to the increase of length and a full statement made in the report. Variations in size and shape of the rattler other than length will give losses not accurately comparable with the standard and tests should be restricted to the 28-inch rattler.

It should be explicitly stated that the recommendation for a standard method must not be held as advocating the exclusion of other tests or as claiming the adequacy of the rattler test as a criterion of the quality of paving brick. Properly conducted, this test gives evidence concerning wearing properties of the brick and as such it is entitled to weight in forming a judgment of the brick.

A paper on the "Local Park System of Wilmington, Del.," by Theodore A. Leisen, the engineer and superintendent, was read by the secretary. This paper with its illustrations will appear later.

The Committee on Street Paving, George W. Tillson, chairman, presented a report introducing a number of papers which were read Wednesday afternoon and Thursday morning. The list included "Asphalt and Its Compounds in Nature, Sources of Supply, Analyses, Principal Uses in Engineering," by J. W. Howard, C. E., New York City; "The Possibilities of Coal Tar in Bituminous Pavements," by Fred J. Warren, Boston, Mass.; "Pavement Guarantees," by Geo. W. Tillson, Brooklyn, N. Y.; "Relative Merits of Portland and Natural Cements in Pavement Foundations," by C. H. Rust, city engineer, Toronto, Ont., "Recent Ex-

EXCHANGE STREET NEAR WASHINGTON, GENEVA, N. Y. IN FORMER DAYS.

EXCHANGE STREET NEAR WASHINGTON STREET EXTENSION, GENEVA, N. Y., WITH ASPHALT PAVING.

perience with Wood Pavements," by B. T. Wheeler, superintendent of streets, Boston, Mass., read in his absence by his secretary, Mr. E. P. Sands; "Wooden Pavements at Home and Abroad," by F. A. Kummer, New York City. Several of these papers follow, others will be given later.

REPORT OF COMMITTEE ON STREET PAVING.

Geo. W. Tillson, Chairman, Brooklyn, N. Y.

At the last meeting of this society the Committee on Street Paving presented papers upon the standard construction of stone, brick and asphalt pavements, those three being the materials then in general use for street pavements. Since that time no radical departure has been made in the construction principles presented in the different papers.

It must not be understood, however, that no experiments are being made or changes proposed in paving materials or their mode of preparation. Efforts will always be made to cheapen the cost of all manufactured products.

Wood has been used at intervals as a paving material in this country since the early forties, but never with any great degree of success. So many varieties of this material have been experimented with and in so many different ways that the results must vary widely and a conclusion in one case be by no means binding upon another. Between 1880 and 1890 a large amount of the so-called cedar block pavement was laid in cities of the central west. It was cheap and at first pleasing and so became very popular in boom cities. But only a few years were required to demonstrate that as a true paving material it was a dismal failure. So complete was this that for a long time no city was bold enough to seriously propose wood as a paving material.

During the last few years Indianapolis has been laying wood pavements of well selected material, creosoted to prevent decay and in a good and substantial manner. Their success, whether real or apparent, has created a new interest in this material. In order to place the subject properly before the meeting the committee presents one paper on wood pavements in this country and Europe and another describing an experiment recently undertaken by the city of Boston.

The great popularity of asphalt pavements has caused many attempts to be made to obtain the results of asphalt, without its cost. Previous to 1876 some 140 patents had been taken out for bituminous pavements and since then the work has been constantly going on. Coal tar has been frequently used instead of asphalt to furnish the bitumen with varying results. A so-called tar-macadam originating in England but used for some years in Hamilton, Ontario, has attracted much attention during the past year both in the engineering and secular papers.

A patent has also been applied for in which the broken stone of ordinary macadam is to be held in place by the ordinary top material of an asphalt pavement but the committee knows of no place where this has been laid.

A paper will be presented describing somewhat in detail the possibilities of coal tar in bituminous pavements.

In speaking of asphalt pavements the committee deems it important to call attention of the society of the increased use of that material upon New York streets of heavy traffic. Broadway will soon have an asphalt pavement as far south as Canal-st. and the calls of the property-owners for its extension to the Battery show that the authorities are behind rather than ahead of the wishes of the public. There is no question but this is an expensive pavement for such a street and whether the limits of economy have been exceeded can only be learned by experience. This street being the leading business thoroughfare of the country is certainly entitled to the best pavement that can be obtained.

The daily press and the consular reports tell of glass pavements being used in certain parts of Europe as well as certain devices to make stone pavements less noisy. But these as yet are simply experiments, the value of which can only be demonstrated in time.

The leading paving materials in use in this country at the present time are asphalt, brick and stone blocks.

THE POSSIBILITIES OF THE USE OF COAL TAR IN BITUMINOUS PAVEMENTS.

By Fred J. Warren, Boston, Mass.

In judging of the possibilities for the use of any material it is best, if possible, to form an opinion based on practice rather than upon theory, and this is especially true when dealing with the bitumens.

The bitumens vary by insensible degrees from natural or artificial gas into the oils, malthas or tars and then into cements or pitches and passing the state of a cement into glance pitch or export pitch, and finally into a coke with no cementing property whatever.

The office of the bitumen in a pavement is to bind mineral particles together in forming a bituminous mortar or concrete.

It is quite evident at many points it is entirely unsuitable for use in pavement work.

Asphaltum and coal tar are names applied to impure bitumen, and the percentage of bitumen in any given crude or refined material varies greatly, and naturally the quantity to be used depends upon its purity; yet the purity has no relation to its quality, and in fact it is frequently the case that the non-bituminous matter native to a bituminous cement is quite essential to efficiency, and if not present naturally its equivalent must be supplied. According to the presence of the mineral, the component parts of the pavement mixture should be varied.

It should be understood that the best chemical authorities agree that bitumen has no fixed combination or composition of qualities, and that its nature and physical properties are as various as its source of supply. It is simply a mixture of various hydro-carbons, and may be either a solid or a liquid.

Prof. Regis Chauvenet, one of the best mineralogists of today and president of the Colorado state school of mines, has said: "Of course any person sufficiently skilled in manipulation can try practical experiments on commercial substances, but so far as analysis is concerned, I do not hesitate to say that I would not venture on the examination of a bitumen to pronounce on its value as a paving material."

Prof. Albert H. Low has said: "It becomes important to know to what extent a chemist can be of service in bituminous pavement construction.

"It may be answered that a chemist who has made a special study of the subject can, by proper chemical analysis and by certain physical tests, point out what is probably good or worth trying, but it is impossible to say it will be fully equal to one that has proved a success.

"Having learned by experience the chemical and physical differences between good and bad samples of any particular material, the chemist may thereafter afford valuable assistance in the use of that material."

I may add that my experience has been that chemists who have not made a special study of bituminous pavement construction can give no advice worth the having and frequently give advice which is so misleading as to be worse than useless; but a chemist of training and experience in the business or with the practical use of bitumen can furnish certain chemical and physical conditions which are invaluable to those in charge of work, and without which it is impossible to accomplish good results on a large scale.

It should be considered:

1. That the physical condition of coal tar varies in its native state from different supplies, and

2. That its physical conditions can be greatly changed by refining and chemical treatment.

3. That it can be ruined by overheating.

4. That the manufacturers have used almost every grade of gas works refuse without special treatment, and

5. That none of the modern methods of attaining exact uniformity of consistency of bituminous cement have been employed by the manufacturer in the preparation of coal tar cements.

In the above will be found one, and the principal cause, of poor bituminous coal tar pavements.

It should be considered in addition:

1. That the manufacturers of the coal tar cements have not been interested in the laying of pavements and have had but little knowledge of the practical requirements.

2. That the contractors for the pavements have generally adopted hand methods, which would not accomplish uniformity.

3. The contractors have not followed the

development in the grading and selection of the mineral aggregates.

4. They have generally been roofers, or others who have done business only locally, and have had a general or technical knowledge of the materials being used, and while all could distinguish great physical differences in the manufactured material furnished they had no way of improvement, nor sufficient interest to study the matter carefully.

The physical differences in the pavements grow out of all these conditions and pavements have been built, and are still being built, largely for sidewalks, with all grades of material, from limpid, liquid water gas or blast furnace gas tars to hard brittle pitches, with all, or practically all, of its life removed, and these varying materials have been used in all kinds of proportions.

The possibilities of the use of coal tar in bituminous pavements may be judged by the hundreds of small pieces of sidewalk pavements and many sections of roadway pavement in cities of this country which are in a good state of preservation after many years of use and exposure.

These samples may not represent ten square yards out of ten thousand square yards that were laid more than twenty years ago, and in some cases over forty years since, but they are of sufficient number and quantity to demonstrate the possibilities.

The large quantity of pavements in which coal tar or coal tar cements have been used and which have failed, or have partially failed, only illustrates the lack of knowledge, care and uniformity in the manufacture of the pavement and the preparation of the cement.

The making of a bituminous pavement is a very complex matter, and one who undertakes to do good work without the aid of extended practice and records of conditions and results will find that variations of conditions which to him are entirely unnoticeable make a vast difference in results.

At this time the most expert bituminous pavers confine themselves largely to duplicating in detail the exact conditions which have previously produced good work, and spend large sums in keeping records of all conditions present, both from methods and grades of material used and by analysis of the resultant mixture; while others without this expense often do good work by duplicating the proportions of the more careful.

The entire advance of scientific methods as applied to bituminous street pavements has been confined in the past almost if not entirely to the use of natural asphalt. This also applies to the manufacture of the bituminous cements.

If the bitumen used lacks cementing properties it fails to do its work properly. If the bitumen is too soft the pavement may be useless and will cut up and roll and will not sustain traffic.

If the bitumen is too hard it fails to be a cement or binding material in cold weather and cracking is liable to occur, and wearing takes place rapidly from the surface, in consequence of the mineral particles of the pavement becoming dislodged from its body by traffic.

This wear might also be produced by disintegration from water, or by the use of improper bitumen, or the cement may, and often is, ruined, or its life shortened by exposure in minute particles by use of improperly graded mineral grains.

In my study of the subject I have tried to avoid theories and have made an effort to detect and record conditions by a careful chemical and physical analysis of the pavements in use, paying as much attention to early failures as to those in use more than twenty years.

The recorded details are too voluminous for this paper, but furnish ample reason for the opinion that it is only a question of further recording of all conditions of construction and careful development to produce bituminous pavements with coal tar cements of great economic value.

The uniformity of the failures under certain conditions and the uniformity of the successes under other conditions is quite noticeable.

One condition quite contrary to the generally accepted practice in the manufacture of bituminous pavements is worthy of note, and that is that the very oldest bituminous pavements in this country have a coal tar cement as a base and have a coarser grain than has been used or considered proper in bituminous pavements, and all of them have a smaller percentage of voids in the mineral aggregate than is possible where only fine sand and stone dust is used.

Another notable condition is that none of the oldest coal tar pavements have a hydraulic concrete foundation.

The analysis of a large number of old and new pavements and a careful consideration of recorded conditions on the subject seem to justify the conclusion that the life of a

SENECA STREET, GENEVA, N. Y., WITH COBBLE PAVEMENT.

SENECA STREET, GENEVA, N. Y., WITH ASPHALT PAVEMENT.

bituminous pavement depends largely on the following conditions:

1. The proper selection of a good quality of crude bitumen.

2. The careful manufacture of the bitumen into a cement without overheating and by proper process which will not injure, but improve its physical properties.

3. The preparation of a cement of the right consistency to accomplish the longest life possible with the mineral aggregate used.

In determining the consistency of cement the following should be considered:

1. That the softer the cement the longer its life.

2. The coarser the mineral grain the greater rigidity produced by the grain itself.

3. The coarser the grain the fewer the voids, if the sizes are properly graded.

4. The fewer the voids and the coarser the grain the heavier is the bituminous coating where the same percentage is used.

5. The more thoroughly the surface is bound to the foundation the less liability of waving and, consequently, the possibility of using a softer cement.

It should also be understood that the life of the bitumen depends upon its use in a dense mineral mixture, and that no bituminous pavements have ever produced long life where the voids in the mineral aggregate were not practically completely filled with bituminous cement.

All bituminous materials are subject to evaporation, oxidizing or apparent drying on exposure, and the length of time which it takes to change the physical nature of the bitumen depends upon the condition of its exposure. If exposed in minute particles around the fine grain of sand, where, for instance, there may be a coat of less than 1-4000 of an inch in thickness, then on exposure the hardening of the coal tar cement would be so rapid as to cause a very short life; while, if the mixture is absolutely dense, the cement on exposure does not change its physical condition for many years except on the surface and acts as a permanent binding material.

If the above conclusions are correct, then a bituminous concrete wearing surface, using coarse particles of stone and thoroughly binding the wearing surface to the base which will hold it in place, will furnish the best tar pavement possible.

It should be understood, however, that a pavement which would be entirely satisfactory laid on top of a crushed stone foundation where the top would bind into the foundation, might, if laid upon a smooth concrete surface, slip and slide and prove absolutely worthless.

I have in mind a pavement which was laid recently by the company with which I am connected and where the surface mixture had been entirely satisfactory laid on top of a coarse rolled stone foundation; but the surface on a small section laid experimentally on top of a smooth foundation has waved to such an extent as to be very unsatisfactory. With the exception of the foundation, the methods and materials employed and the traffic conditions were identical.

PAVEMENT GUARANTEES.

By Geo. W. Tillson, First Ass't Engineer, Dept. of Highways, Brooklyn, N. Y.

Previous to the introduction of asphalt as a paving material, the question of pavement guarantees did not demand much attention. Wood being practically the only perishable material in use, and that to no great extent, a pavement was supposed to last until it was worn out. But when coal tar was used in the sixties, this supposition was found to be incorrect, and when later asphalt, a new and similar material, was proposed, it was necessary to do something to make city officials sure that they were at least getting something definite for their money.

To accomplish this, the idea of guaranteeing to keep the pavement in good condition and repair for a term of years, at the regular contract price, arose. This scheme soon became very popular, and to its effectiveness can be credited, in a great degree, the rapid progress of asphalt pavements. While public officers and property owners might be in some doubt as to the durability of the material, they were at least sure of a good pavement for a specified time.

Later, when granite blocks, with tar and gravel joints, and bricks, came into general use, making, with the asphalt, what are now called improved pavements, this same principle was applied and at once became of great importance in paving contracts.

The subject naturally divides itself into

three heads, viz: 1st. Length of guarantee. 2d. Requirements of guarantee clause. 3rd. Payment of the guarantee.

The following table shows the practice in this particular in twelve of the principal cities in this country:

	Period of Guarantee, Years.				How Enforced.	Retained Money, if Any, How Paid.	Requirements of Guarantee.
	Asphalt.	Brick.	Stone.	Wood.			
Boston	10	.....	10	10	Bond.	.....	Satisfactory to superintendent of streets.
Buffalo	10	10	10	10	Bond.	.....	Satisfactory to chief engineer.
Chicago	10	10	10	2	Bond.	.....	Good condition, ordinary wear excepted.
Cincinnati	5	2	2-5	.....	10 % of contract price retained.	At end of guarantee period.	Good condition and repair.
Cleveland	10	3	5	.....	Brick and stone 2¼ cts. per sq. ft., asphalt 10 % of contract retained.	At end of guarantee period.	Good condition and repair.
Columbus	10	5	5	.....	10 % of contract retained.	At end of guarantee period. City pays 6% on money retained.	As recommended by Am. Soc. Mun. Imp.
Detroit	5	0	0	0	Bond.	.....	Satisfactory to Dept. of Public Works.
Indianapolis	9	9	.....	9	*a*20 cts. per yard retained.	At end of guarantee period.	*c*Specific.
Milwaukee	5	5	5	0	10 % of contract retained.	At end of guarantee period.	*c*Specific.
Borough of Brooklyn, N. Y.	*b*5 10	5	1	.....	{ 5 years, bond. { 10 years, 20% of cost of asphalt.	10 years, 4 % at end of sixth year, then 4 % annually.	*c*Specific.
Philadelphia	*b*5 10	5 10	5 10	.....	Bond.	.....	Satisfactory condition and to city grade.
Toronto	10	10	10	1	Asphalt, 15 % of contract retained.	At end of guarantee period.	Satisfactory to engineer.

a—The deposit is generally made in street improvement bonds, bearing 6 % interest, the contractor drawing the interest if repairs are made.
b—On original improvements, 5 years; on streets repaved with improved pavements, 10 years.
c—Given in detail in text.

The object of this paper is to consider the practice in detail with a view of giving the writer's opinion of the proper requirements and the principles governing in each case.

1. Length of Guarantee. Before deciding on this point it will be necessary to consider just what is expected of the guarantee. Is it simply to protect the city from the decay of a perishable material, or against poor workmanship and material whose exact nature could not be discovered in a short time test, or is it to provide the municipality with a pavement absolutely free from cost for the entire guarantee period? It will readily be seen that these different conditions will modify the requirements.

In the case of asphalt it was undoubtedly originally intended to indemnify the city from any loss on account of poor material, poor workmanship, action of traffic or deterioration of material for any reason whatever. No one knew what the condition of the early asphalt pavements would or should be at the end of five years, but the intention was to give a good pavement for the length of time. Even now it is doubtful if any engineer or chemist would be ready to accept finally any asphalt pavement when it was first laid. It is a perishable and complex material, and the guarantee period

should be long enough to demonstrate fully that the crude material was up to the proper standard. It may be said that this can be ascertained by chemicals. This is doubtful. It would be extremely difficult to have every load of material so inspected as to be absolutely sure it was all right. The asphaltic cement might be unknowingly burned, or if known, the knowledge kept from the superintendent. There are many ways in which an asphalt can be injured while the pavement mixture is being prepared, and all these chances should be taken by the contractor, as he agrees to lay a good pavement, and the guarantee period should be extended long enough to determine this fact.

One of the common ways of an asphalt pavement becoming defective is by cracking. In some sections of the country this is not important, but in the West, where extremes of temperature are great, it is often the first sign of failure. This cracking sometimes takes place the first winter, but generally not till the second or third. The author remembers distinctly some asphalt streets that for three years after being laid were in almost perfect condition, but began to crack and disintegrate during the fourth season, and in the fifth had to be very generally relaid. In this connection it should be said that another street paved with the same mixture as those mentioned above, but which sustained a much heavier traffic, proved much more satisfactory in the end, although at the close of the third year it looked as if it would require repaving when the guarantee expired. The heavy traffic was a benefit to the pavement.

It would seem then that the early promoters of asphalt pavements builded more wisely than they knew, and that five years is the proper period for determination of the character of the pavements. In several cities where the law requires the property-owners to pay for the original pavement, but that all repairs must be made by the city at large, it has been declared illegal for the city to receive bids for a longer guarantee period than five years, when it was proposed to assess the cost against the abutting property. If it be desired to make the period longer, that is simply a business proposition, and the increased price will be a measure of the contractor's estimate of the cost of repairs for the additional time.

In the case of brick, however, the conditions are somewhat different. It is only within the past few years that brick has been generally accepted as a paving material. A good paving brick is imperishable as far as the elements are considered. But there is a great variation in so-called paving brick. Because one kind will make a good pavement, it does not follow that another will, unless alike in its important properties. This fact it is not easy to determine. If brick of a certain make have been tested by use it is comparatively easy to select good bricks manufactured by the same firm.

With brick it is only necessary to provide against poor workmanship and improper material. The former can be ascertained in a few months, the latter not so soon, so as five years have generally been decided upon as the unit of an asphalt guarantee, and as brick must compete directly with asphalt, it would seem to be doing no wrong to the former material to require that it should be guaranteed for the same length of time, and also that it would be just to the property-owner. For it must be clearly understood in this discussion that any unjust requirement, while complied with by the contractor, must be paid for by the general public.

With stone the case is still different. Here it is known just about what the material will stand, and what its nature is when laid. Intelligent inspection will easily determine that, so with a stone pavement bad construction is the only thing, as a rule, that should be protected by the clause. If the blocks are laid on concrete, with tar and gravel joints, the defects will generally be an uneven surface produced by traffic on account of deficient ramming, some blocks that may have escaped the inspector's eye, and open joints between the blocks because the interstices of the gravel were not filled with tar. All of these deficiencies can be discovered during the first eight or nine months, but, as it is always safe to allow winter to elapse before the retained amount is paid, the conservative period for a stone block pavement would be one year.

2. Requirements of the Guarantee Clause. This is an important matter, and the clause should be so worded as to make clear just what the contract requires. The early contracts were very remiss in this respect. They guaranteed the pavement for a term of years, but said nothing as to its exact condition. It will be noticed by reference to the table that of the twelve cities given there, only four make any attempt to be specific. The others require that the condition shall be satisfactory to the city officials.

This is not very definite and when, in

BOSTON CITY ROCK CRUSHER, IFFLEY ROAD.

many instances, the officials under whom the pavement was laid are not in the office when it is finally accepted, the way is open for many complications. That more misunderstandings and lawsuits have not arisen under this clause can be attributed to the fairness and good sense of public officials generally, and the willingness of paving contractors to do what is just and sometimes even more in order to avoid a suit. But there should be no occasion for these misunderstandings, and with a properly worded clause, they need not arise. This society has officially recognized this fact, and in 1897 adopted a report of the committee on street paving which recommended specific requirements for the guarantee clause. Very few cities, however, have attempted to follow out these recommendations.

One point of difference that has often arisen in the interpretation of the maintenance part of the clause is whether the contractor should make good settlements occurring over sewers or other trenches. The writer has always held that he should provided that the sewer had been constructed previous to the bidding; otherwise he should not, on the principle that he must be governed by the condition of the street when he bid. If the city change or allow the conditions to be changed it, and not the contractor, is responsible.

In recent years much damage has been caused to asphalt pavements by illuminating gas, and the question has arisen who shall pay for the repairs. While there does not seem any doubt that eventually this cost can and will be paid by the gas companies, it is quite important to know whether this is to be enforced by the city or the contractor. As these companies are supposed to be under the control of the municipality, and as any damage from gas would be something wholly outside the power of the contractor to prevent, it seems no more than right and just that this risk should be assumed by the city. It must be understood at all times that the contractor must be paid for all chances that he assumes and that this amount will be included in his bid. Any damage from fire would unquestionably be paid for by the city; why not then damage from gas, when it can recoup itself from the gas companies. The above assumes, of course, that it can be definitely proved that the damage is caused by the gas.

At the present time it is known about how long a good asphalt pavement will last, under ordinary conditions, and it would seem that a guarantee against workmanship and material would be sufficient for maintenance during the guarantee period with definite directions as to its condition at the close.

Of the four cities in the table specifying conditions at end of guarantee, Columbus, O., says it shall be as recommended by this society. Indianapolis, "This guarantee shall cover all repairs growing out of the imperfection or unsuitability of material or composition, too great or too little moisture, all defects of workmanship, extremes of heat or cold and all other effects of climate, and covers all other deteriorations more specifically described as follows: In case of asphalt, brick, or wooden block, any holes or cracks in said pavements, and any defect resulting from the decomposition of the wearing surface or foundation. The pavement at the end of the guarantee period shall be in good condition, present surface so true and even that it shall in no way be an obstruction to travel, and have drainage so perfect that water shall collect in no place to a depth of more than one-quarter of an inch. . . . The determination of the necessity for repairs rests entirely with the board of public works, whose decision on the matter shall be final and obligatory upon the contractor."

Milwaukee; asphalt. "The contractor must do all the work required by this contract in such a good and substantial manner that at the end of five (5) years from and after the completion of the contract, the pavement shall be free from any cracks, rolls or other defects caused by the workmanship or material, detrimental to travel, and that neither the weather nor the legal travel of the street shall have caused the surface coat to be reduced more than twenty-five (25) per cent. of its original thickness. In the event of the failure of the pavement to conform to the above requirements the contractor is, during such period of five (5) years, to make at his expense such repairs from time to time as in the judgment of the Board shall be necessary to make the pavement comply with such requirement." For brick the clause is the same except as to condition at end of period, which reads "the pavement shall be free from any broken brick or settlement or other defect detrimental to travel caused by the use of improper material."

New York; asphalt. "That just previous to the expiration of the guarantee period

the entire work shall be inspected, and if any surface cracks or disintegrations shall exist or any bunches, depressions or unevenness in the surface of the pavement shall show a variation of three-eighths (⅜) of an inch under a four (4) foot straight edge or template, or any portion of the pavement shall have a thickness of less than one and a half (1½) inches such portion or portions shall be immediately repaved by the contractor upon the order of the commissioner, by the heater process, or, when required, by removing the pavement from the foundation and replacing it in the same manner as when originally laid; provided, that when more than fifty (50) per cent. of the surface of any one block requires repairing, according to the above conditions, the entire block shall be taken up and relaid. Whenever any defects are caused by the failure of the foundation the pavement including such foundation shall be taken up and relaid in accordance with the specifications. That the period of maintainance shall be in force through the term of years aforesaid, irrespective of any changes that may occur in traffic conditions, on or across said street, whether due to the widening of said roadway or to the construction, reconstruction or rearrangement of new or existing surface or sub-surface constructions thereon, or to any other cause."

The difference between the Indianapolis clause and those of Milwaukee and New York will be noticed. The former is for protection against improper material and workmanship, while the latter provide for a new pavement if more than one-fourth of the wearing surface in Milwaukee, and pavement in New York, has been worn out. The one is for repairs during the guarantee period and the others protect against the action of travel, no matter how well the pavement may be laid. The New York clause is taken from a ten-year contract, and it is quite probable that a large portion of the pavement will be reduced to less than the limit at the end of that time. If any city wishes to insert such a provision in its contract, it is eminently proper to do so, but it should be understood that it is a provision for general maintainance rather than repairs. The one seeks to keep the pavement in a certain condition for a term of years, the other to make good defects of material and original construction. It is taken for granted in this connection that the material selected will last naturally the guarantee period if properly laid. Otherwise the choice is forced. This, of course, is perfectly allowable in special cases. Then the contract becomes one for construction and practically another for maintainance.

For an asphalt pavement under a five years' guarantee the writer believes the Indianapolis clause to be a good one. Its provisions, if carried out, would produce a good pavement, and they are sufficiently specific to permit a simple and equitable adjustment at the end of the guarantee period. Adding a condition as to the thickness of the wearing surface at the end of any term of years would properly extend it for any time. The New York clause determines the roughness of the surface by measuring from a straight edge, and the clause from the Indianapolis specifications by the depth of water in depressions, the only reference to bunches being where it is said it shall not obstruct travel. The exact depth of the depression to be allowed and the minimum thickness of the pavement are purely arbitrary and must be determined by local conditions, but these decisions will make a material difference in the price bid for an asphalt pavement, especially for a long period of guaranty.

For a block pavement, whether of stone or brick, the clause should require the pavement to present a true and even surface; that any individual block or blocks that shows any indication of abnormal wear should be taken out and replaced with new, and that all imperfect joints should be made good with the same material as originally required. In the case of a new and untried brick it would be well to require that if the thickness during the guarantee period should be reduced below a certain amount, estimated to be the same as a well known standard brick, the reduced portion should be taken up and relaid.

3. Payment of Guarantee. This has an important bearing upon the amount of the bid. It is recognized that whenever a guarantee is required the contractor must obligate himself in some way to fulfill the requirement. In five of the twelve cities referred to in the table a bond only is given for this. In the other seven a certain amount of cash is retained when the work is completed. In some cities this is a specified sum per square yard, and in others a percentage of the cost of the pavement. This amount should, of course, vary with the length of the guarantee. Cincinnati and Milwaukee retain 10 per cent. of the con-

tract when this period is five years; Indianapolis 20 cents per square yard for nine years, and Columbus 10 per cent.; New York 20 per cent. of cost of asphalt, and Toronto 15 per cent. for a ten-year period. Whether a bond and a certain amount of retained cash should both be required has often been discussed. Theoretically it should make no difference, as the bids should be governed by conditions. But with a price once established small changes do not raise or lower this very materially. No unnecessary conditions, however, should be imposed. It does seem, however, that where a specific condition of the pavement is guaranteed for a term of years a sufficient sum should be retained to make the pavement good at the end of that time. If actual cash is due the contractor he will be much more anxious to have the work in satisfactory shape than if a bond is to be released only. If the money is in the city treasury small repairs can be made much more simply than by proceeding against the bond. Any general resurfacing would probably require that method in the event of a refusal of the contractor to make the called for repairs.

It will be noticed that Columbus pays 6 per cent. on the retained money and that Indianapolis allows the security to be in the form of street improvement bonds, the contractor receiving the interest.

The money withheld is for the purpose of making repairs, and, until the guarantee period has expired and the repairs made, the contractor has not earned the money and certainly is not entitled to any interest. The theory of the New York clause is that the unit of asphalt pavement life is five years and that no special payment shall be made for repairs for that period. During the past two seasons the cost of asphalt (wearing surface and binder) in Brooklyn has averaged $2.00 and $2.35 per sq. yard for five and ten-year guarantees, respectively. That is, the additional five years have cost 35c, or 7c per yard per year. There is retained when the work is completed 20 per cent. of the cost, which would amount to 47c per yard, somewhat in excess of the bid. This is paid to the contractor as he earns it, beginning at the end of the sixth year, 4 per cent. annually till the guarantee has expired. Can any one claim that he is entitled to interest on these sums?

It having been decided to retain a certain amount of money for repairs upon the completion of the contract, the question arises when it shall be paid. All of the cities' retaining money, except New York, hold it until the end of the guarantee period. This does not seem necessary as the pavement is supposed to be kept in good condition, and it seems perfectly just and proper that an annual amount to correspond to this work should be paid, making the contract, as has been suggested, practically one for five years without extra cost, with a specified sum for repairs for the remainder of the term. The writer would suggest then that if the guarantee period for asphalt and brick be taken at five years a bond be given for its maintenance and repairs during, as well as the condition of the pavement at the end of, this period and that the sum of ten cents per yard be withheld during the same time for incidental repairs in case they should be not made by the contractor when required. The bond to be released and retained money paid at the end of the period if the pavement be in accordance with the contract requirements. For a ten years' guarantee it is believed that the New York practice already described is perfectly satisfactory. Its only objection is the amount of bookkeeping involved and in most cities this would not be very much.

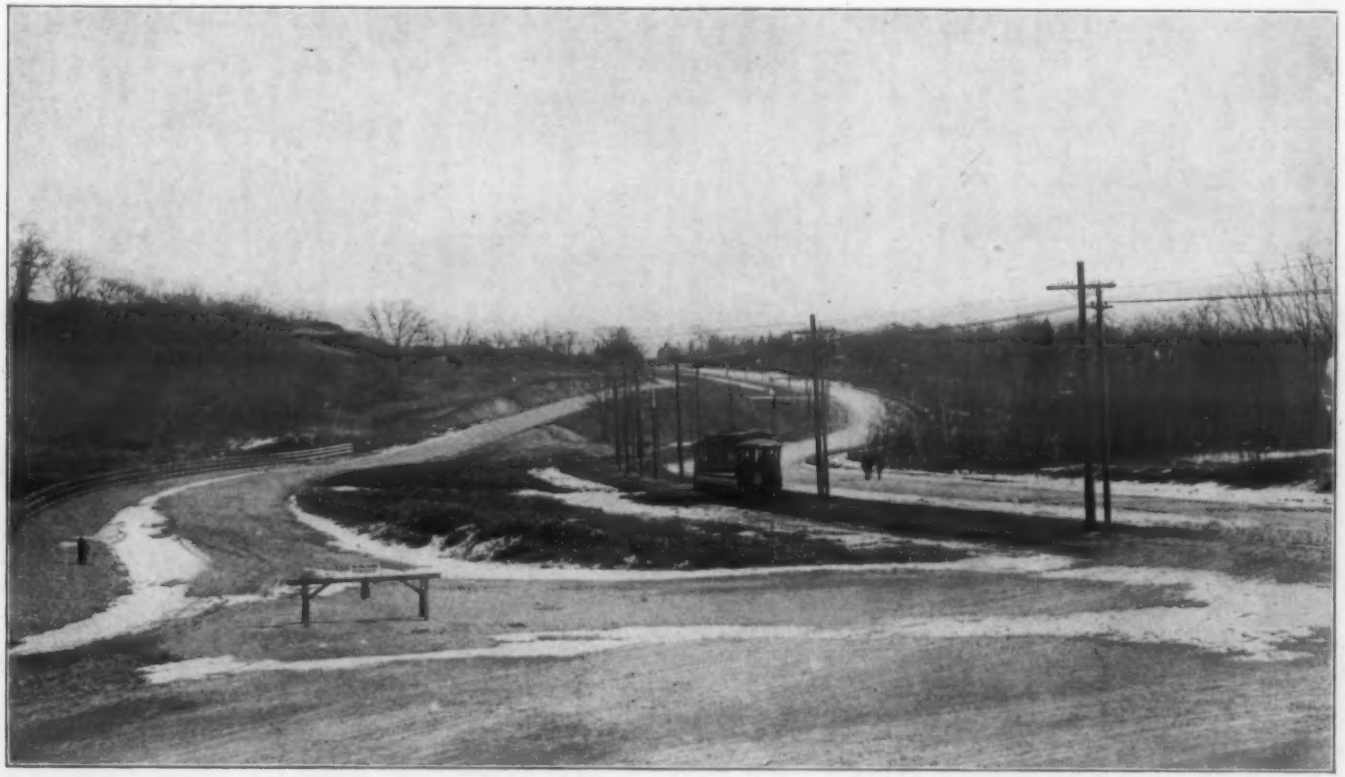
For a one-year guarantee on stone ten cents per yard should be retained and the bond maintained in force until the work is finally accepted.

THE RELATIVE MERITS OF PORTLAND AND NATURAL CEMENTS FOR STREET FOUNDATIONS.

By C. H. Rust, City Engineer, Toronto, Ont.

The almost universal use of natural cement a few years ago was owing to its very low cost and to the fact that all Portland cement was imported, thus making its cost very high, and engineers were probably justified in encouraging home industries. But in view of the excellent quality and reasonable cost of the Portland cements now manufactured in America, it appears to the writer that the time is not far distant when the use of natural cement will be almost entirely discontinued.

The writer regrets very much that his experience with natural cement is very limited, and only applies to that manufactured in Canada.



COMMONWEALTH AVENUE, NORTH OF WALLINGFORD ROAD, BOSTON, MASS.

It is beyond dispute that better results are obtained by the use of Portland cement. In Toronto, Portland cement has been used entirely for the past eighteen years, the natural cements being found unreliable, and in Canada at the present time Portland cement is almost entirely used on all public works. In Toronto upon two or three occasions, when calling for tenders for paving work, we have obtained prices for concrete made of Portland and also of natural cement, the specification for the latter calling for 1, 2 and 5 and for the former 1, 3 and 6, but the difference in the figures has not been sufficient to warrant the engineer in recommending the use of natural cement.

The United States has been particularly fortunate in having large depcsits of natural cement rock of a high quality, and it is only within recent years that the manufacture of Portland cement has been undertaken in this country, the first Portland cement made being in the early seventies, by Mr. Saylor of Coplay, Pa.

Referring to the description of cement used by different cities, the writer has in his possession a table, compiled by Mr. F. V. E. Bardol, City Engineer of Buffalo, in connection with asphalt pavements, which shows that out of forty-three cities twenty-eight use natural cement and fifteen Portland.

From the table referred to above it is ascertained that the average cost of concrete for asphalt pavements with natural cement is $3.88 and with Portland cement $5.56 per cubic yard, the proportions of natural cement being 1, 2 and 4 or 1, 2 and 5, and for Portland ranging from 1, 3 and 4 to 1, 3 and 7. Natural cement costs from 50 cents per barrel to 85 cents per barrel, and Portland cement from $1.30 to $1.50 per barrel.

The advantages of Portland over natural cement are:

1. It sets quicker.
2. It attains its strength more rapidly.
3. It is less injured by frost.
4. A greater proportion of sand can be used with it than with natural.
5. The work can be continued later in the fall than when natural cement is used.

These advantages are of great consideration in the construction of the foundation of street pavements, where it is absolutely necessary that the public be inconvenienced as little as possible. In Toronto we frequently lay foundation for pavements in December, the frost appearing to have very little effect, providing the weather is not too cold.

The only advantage of natural cement over Portland cement lies in its cheapness.

The writer has not considered it necessary to give any results as to the tensile strength of the different kinds of cement, the members of the society being no doubt thoroughly familiar with this matter.

The good quality and low cost of Portland cement has resulted, in many places, in the substitution of concrete for stone, and has effected a very large saving. This is especially the case where a suitable stone is not obtainable within convenient distance and at a reasonable cost. In addition it has also resulted in almost entirely displacing wood and stone for sidewalks.

In connection with this paper the writer thought it would be interesting to refer to the use of the so-called sand or Silica cement, which is produced by grinding together a mixture of Portland cement and sand, usually in the proportions of one barrel of cement to three barrels of sand. It was claimed by the manufacturers of this class of cement that it would give as good results when mixed with three parts of sand as with a pure Portland. Although the tests made in Toronto showed a high tensile strength, the concrete under actual conditions has not been entirely satisfactory, and it has been found, especially during wet, cold weather, late in the fall, that the slow setting qualities of the concrete prevent the paving material being put on as soon as if Portland cement had been used, and the results altogether were such that it has been considered advisable to discontinue its use.

RECENT EXPERIENCES WITH WOOD PAVEMENTS.

By B. T. Wheeler, Superintendent of Streets, Boston, Mass.

The New England metropolis is a city of conservatism. Sprung from the Puritans, her people remain true to the traditions of their ancestors. Their progress has been a slow, but steady, one; their development has been along lines of careful investigation. Cleaving to that which was good, they have not hurried to adopt new conditions until convinced, by demonstration which appealed to their judgment, that an improvement would result. Oftentimes our good city has waited for some more daring

municipality to make the experiment; but she has seldom failed to avail herself of these experiments when they appealed to her judgment, and has often wrought from the crude beginnings of others the finished product which they had not conceived.

Boston's business district is compressed into a comparatively small area with densely crowded thoroughfares, outside of and surrounding which is a large suburban district containing the homes of her workers. Until within very recent years her business section has been paved with granite blocks, her residential streets have been of macadam. Of the four hundred and ninety-one and 85-100 (491.85) miles of public highways within the limits of the city, two hundred and ninety-two (292) miles are still of macadam, and eighty-six (86) of gravel. Within recent years there have been laid some areas of asphalt pavement—only fourteen and 76-100 (14.76) miles in all—in an attempt to give the residential district closely adjoining the business section a permanent pavement which would bear the travel imposed upon it without the noise of granite blocks or the dirtiness of macadam. Asphalt pavement has, however, never appealed strongly to the popular mind. Those who use the streets protest against it in the business sections; it is not desired by the pleasure-driving public in the suburban districts.

The problem of the street department has been for some years to provide a pavement which should be more noiseless than granite blocks, less slippery than and as durable as asphalt, and more permanent as to its wearing surface. During a previous incumbency of the office of superintendent of streets, six years ago, this problem was forced home to me. The Back Bay district of the city, so called, was densely populated with the homes of the wealthy class. Only a few years previous these citizens, protesting against the laying of an asphalt pavement in a boulevard known as Commonwealth-ave., had raised a fund with the interest from which they are paying for a portion of the repairs of the macadam surface which was laid at their request. In 1895 a body of these citizens upon another street in this district had protested against an asphalt pavement, preferring macadam, and their desires were gratified; but during the five years since a change has come to many of these. The popular mind is not more inclined toward asphalt, and still complains of its slipperiness; but it is less inclined to endure the dust which dry weather, and the mud which wet weather, produces upon a macadam surface; and granite-block pavement, even, is sometimes asked for in preference to either.

This city is particularly fortunate, because of its location, in the character of the granite-block pavements which it lays. Surrounded by some of the finest granite quarries of the world, she is enabled to obtain the best and smoothest blocks which nature helps to produce. These are laid, in recent years, upon a six-inch American cement concrete base, with a two-inch sand-bed, and the joints are filled with either road pitch and pebbles, or, during my control of her streets, with Portland cement grout. I believe today that Boston has the smoothest granite-block pavements in this country, if not in the world; but such pavement, while withstanding the wear of traffic and of time, is not fitted for the ear of tired human nature. Macadam has not permanency, is expensive to maintain in good repair, is unsanitary and disagreeable under the varying conditions of climate.

Asphalt, to which large numbers of the cities of this country turn as an expedient and satisfactory pavement for residential and lightly traveled streets, does not fully meet the requirements of our city. Situated on the sea, and traversed by its estuaries, with widely varying temperatures during all seasons, her climate is one for which asphalt seems less adapted than for that of any other large city of this country, because of the condensations of vapor which these climatic changes cause. Whether this moisture upon the surface remains fluid, or is frozen by the morning chill, almost equal slipperiness is produced, and it is necessary, during a surprisingly large number of mornings of the year, to sand completely all well-traveled asphalt streets where laid upon the slightest grade—and Boston, built upon the rugged contours of Massachusetts, having in her business section the three hills which first caught the eye of the voyager of the fifteenth century, has very little area of level street surface.

Until last year, when I again assumed control of the street department, no forms of pavement had been attempted beside those mentioned except unsatisfactory experiments with brick and coal tar concrete. Neither brick nor coal tar products can withstand the traffic of even our densely-populated suburban districts.

In an attempt to solve the problem thus presented, some experiments have recently be made in the laying of wooden pavements, after noting the results achieved in the few sections of this country in which they have been laid.

Treated wooden block paving has been used in London for over thirty years on both her finest and most heavily trafficked roadways. Paris has nearly four times as many square yards of it in use as of asphalt. There had been laid in 1891 four hundred and eighty-four thousand (484,000) square metres, and in 1898 one million one hundred and sixty-five thousand (1,165,000) square metres of wooden blocks, there being at that time three hundred and eighty-two thousand six hundred (382,600) square metres of asphalt and one million three hundred and forty-eight thousand (1,348,000) square metres of macadam.

Foreign growths of wood are, however, practically prohibited for use in this country by reason of their large cost. To produce a pavement at moderate and justifiable expense, a native wood must be used, so treated, if possible, as to harden its fiber, make it practically impervious to moisture, and not readily susceptible to the varying conditions of heat and cold. There is no gauge of durability by which the attempts to produce such results can now be judged. Practice has not yet demonstrated in this country what our natural products can create in the way of a permanent pavement of this character.

There were laid last year in this city, for experimental purposes, in the midst of the otherwise asphalted surface of a busy, but lightly trafficked, thoroughfare, two small areas of wooden blocks, thirteen hundred sixty (1,360) square yards in all, treated by the so-called creo-resinate process. These areas were laid in the steepest grades thereof, and in one case for only half the width of the street, the other half being of asphalt, that the relative merits of the two might be compared.

This pavement was prepared and laid in the following manner:

The blocks are uniformly four (4) inches wide, four (4) inches deep and eight (8) inches long, of long-leaf Georgia yellow pine, free from sap, loose or rotten knots, and with no second-growth timber allowed. These blocks were placed in an air-tight cylinder, and the dry heat was raised to 215 degrees Fahrenheit, without pressure, for one hour, for the purpose of expelling the moisture. The heat was then increased, pressure was applied and the degree of both was raised gradually in order to avoid injury to the fiber, during a period of two hours until the heat had reached 285 degrees and the pressure about ninety pounds, and both were then held at that point for one hour. The heat was then shut off and the tanks allowed to cool gradually for one hour. At the end of this time the heat had been reduced to 250 degrees, and the pressure to about forty pounds. The pressure was then blown off and the heat still further reduced. Vacuum was then applied until about twenty-eight inches was reached; and, while under vacuum, the creo-resinate mixture was run into the cylinders at a temperature of from 175 to 200 degrees, and hydraulic pressure was then applied, reaching 200 pounds per square inch, and kept at this point until from twenty-one to twenty-two pounds of the mixture per cubic foot had been absorbed. The liquid was then run off and the wood placed in another cylinder, and milk of lime at a temperature of 150 degrees was run in and hydraulic pressure of about 200 pounds was applied for one hour.

The blocks were laid with the grain vertical upon a foundation consisting of American cement concrete six inches in depth, with a one-inch cushion of clean, screened sand, and were driven tightly together at every sixth row. The joints were then filled with dry, screened sand and the pavement rolled with a five-ton roller until the blocks presented a firm, uniform and unyielding surface. The joints were then filled with a creo-resinate mixture of road pitch heated to 300 degrees Fahrenheit, and the whole covered temporarily with one-quarter inch dressing of clean, screened, sharp sand.

It is apparent, after a year's experience with this pavement, that it is satisfactory as so laid in every respect except with regard to slipperiness, and that, as so laid, an almost absolutely noiseless pavement was obtained, the surface of which, under use, became so unified that the joints were indistinguishable and the pavement consequently slippery. No wear has yet been apparent. The surface remains perfect and, in comparison with the asphalt adjoining it, it is preferable in all respects, except that of slipperiness, in which, practically, it does not differ; and upon the grade of four (4) per cent. at which it was laid it has nothing to recommend it in this respect.

I have this year laid an area of seventy-nine hundred and forty (7,940) square yards upon a level street, in the same manner as

BRICK SEWER BUILT INSIDE OF OLD STONE SEWER, BOSTON, MASS.

above described, which I believe will be eminently satisfactory in every respect, and am about to lay this fall another area of sixty-six hundred and forty (6,640) square yards upon a nearly level street, where I expect the same results; but the problem of a noiseless, non-slippery and permanent pavement, which can be laid upon grades exceeding two (2) per cent. has not yet been satisfactorily solved. With the hope of more satisfactory results in this respect, however, I have laid upon a three (3) per cent. grade an area of two thousand (2,000) square yards of wooden blocks, so recently put down as not to permit me to make any statement of the results obtained. This was laid from blocks prepared as above mentioned, differing only in shape and in the character of the joint. From each block, four (4) by four (4) by eight (8) inches, there was removed from one side at the top a section one-quarter inch in thickness for the length of the block and one and one-half inches in depth. When these blocks were laid as above described, and driven closely, there was a quarter of an inch opening, or joint, remaining, extending clear across the street with each width of block, one-quarter of an inch wide and one and one-half inches in depth. These joints were filled with Portland cement grout concrete. It is my expectation that this material upon the surface of the street every four inches will remove the slippery conditions which would otherwise exist and furnish better foothold for horses.

There is in my charge, as commissioner having the care, with a representative of the adjoining city of Cambridge, of those bridges crossing the Charles river and connecting the two municipalities, a bridge, called Harvard bridge, having a roadway area of eleven thousand four hundred and twenty-five (11,425) square yards. This bridge was built in 1891 within an insufficient appropriation, and in a manner which has proved to be a falsely economical one. In order to diminish the cost the structure was lightened and designed only to carry a wooden floor of four-inch deck and two-inch sheathing. Traffic upon this bridge has rapidly increased, and it has been necessary for some years to resheathe it annually; and it has now become apparent that two resheathings each year will only suffice. As the deck of the structure now shows signs of decay it has been decided to redeck this entire structure with a hard pine deck, treated by the same creo-resinate process as are the blocks, and directly upon this the wooden block pavement will be laid, closely driven and without joints, and a contract for this work is now being executed by the United States Wood Preserving Company of New York, which controls the creo-resinate process. What has for years had many of the characteristics of an uneven corduroy roadway, caused by the rapid wearing of the sheathing plank, will soon present an even, noiseless, smoothly-riding surface, which will not subject the two cities to the cost of annual repairs. Wooden blocks have therefore filled a unique place in furnishing a permanent and satisfactory pavement, placed upon a structure which was not designed to carry the load of any other form of permanent pavement known.

I was brought to the execution of this work by the experience of the city of Chicago in laying a wooden pavement—treated, however, by another process—upon the Rush-st. bridge, which carried a large part of the freight traffic of an important railroad terminal, and which had required, therefore, many renewals annually of the wooden wearing surface of plank. This pavement had been laid over two years and a half, I think, when I last saw it, and was still apparently in first-class condition. Wooden pavement has, therefore, it seems to me, a field peculiarly its own in replacing the plank surface of bridges in an economical and satisfactory manner.

The only question, aside from the desirability of laying such pavement upon steep grades, which I have already referred to, and which has not yet been satisfactorily demonstrated, is then one of durability, which time alone can determine; but the company which has laid this pavement has, for the protection of the city which I represent, given a good and sufficient guarantee to keep the same in condition satisfactory to the superintendent of streets for a period of ten years.

Wooden pavement has, then, these demonstrated advantages: It is noiseless, it remains where it is put; in other words, it does not creep or crawl, as in the case of asphalt wearing surface, becoming billowy under traffic; it can be taken up for necessary excavation—that bete noir of all street superintendents—and relaid handily, satisfactorily and without large paraphernalia. These known qualities commend it, and I believe that the test of time will prove its durability and its superiority, under moderate traffic and in residential sections, over any other pavement now laid.

Many valuable points were brought out in the discussion of these papers. The general conclusion seemed to be that the guaranty period for the more perishable pavements, such as asphalt and wood, should be about ten years, though five years seems to be the limit of guaranty without appreciable increase in first cost of pavement, additions to the guaranty period resulting in an increase in first cost approximating 7 cents a square yard per year. The necessity of such definite provisions as to condition at the end of the guaranty period as were suggested in Mr. Tillson's paper was emphasized by the speakers.

Regarding the use of Portland cement for concrete under street pavements, most of the speakers were inclined to think the extra expense hardly warranted, except for such cases as Toronto, described in Mr. Rust's paper, where the natural hydraulic cement obtainable is not reliable and the extra expense of Portland cement is necessary to acceptable work. Mr. Fisher stated that the extra cost of Portland cement in Rochester was 17 to 25 cents a square yard, and Mr. Brown that with a second grade Portland cement it was 21 cents with cement at about $1.90 a barrel. Both these cities are close to natural hydraulic cement factories, where all grades of cement can be procured. Mr. McMath stated that he had never known of any defective natural cement concrete foundation. There might be difference of opinion as to the definition of the word defective. Certainly Portland cement makes a more solid sheet and the replacing of the concrete over trenches gives more satisfactory results. It is true, however, as most of the speakers intimated, and as Mr. McMath stated in his annual address, that economy in engineering requires that proper attention be paid to the period of time for which the construction is expected to exist, and expenditure which would prolong the life of the pavement beyond this time is unwarranted.

In the discussion of wooden pavements a material change in opinion from that shown at the Chicago meeting in 1896 was manifest. The success in Indianapolis on the lines suggested in part by Mr. Downing in his paper at that time is largely responsible for this change, and the application of foreign methods of construction and of American improvements upon them, evidently encouraged the speakers to hope for a wooden pavement which, on the whole, would compare favorably with asphalt. To correct some misstatements regarding Indianapolis pavements, Mr. Brown gave a short sketch of the history of the wooden block pavements of Indianapolis beginning, before the establishment of a local creosoting plant put the cost of that process within reach, with a rather soft rectangular "red cedar" block laid on concrete foundation, the pavement being expected to wear out before it decayed, thus keeping the surface more nearly smooth than if decayed blocks produced frequent holes. This pavement is more than fulfilling the promises made for it. It was followed by yellow pine blocks very slightly treated with creosote and laid in the same manner, except that the lines of blocks were laid on diagonals, and this by the same blocks filled with 10 pounds of creosote per cubic foot. The first pavement was laid in 1895, the second in 1896 and the last in 1897 and later. No repairs are reported to the pine block pavements aside from those due to swelling of the street surface after long dry periods like that of the past summer, when shrinkage of the blocks drying out and filling of joints with dirt caused uplifting of the pavement about any obstructions in the street when the first rain fell, requiring removal or trimming of blocks to bring the surface down to the normal. Mr. Rust gave an interesting description of English pavements, reporting the decline in popularity of Australian wood. He was in favor of wooden blocks, even with the inferior construction in vogue in his city. Mr. Lewis and Mr. Bardol reported their changes of opinion regarding the possibilities of wooden block pavements after inspection and reports of their comparative success.

The report of the Committee on Sewerage and Sanitation, A. N. Talbot, chairman, served to introduce the papers obtained by the committee, "The Cost of Sewer Construction," by Emmet Steece, city engineer, Burlington, Iowa; "New Sewage Purification Plant of Madison," by Prof. F. E. Turneaure, city engineer, Madison, Wis.; "Engineering Phases of the Work of Municipal Boards of Health," by Marshall O. Leighton, health inspector, Montclair, N. J.; "The Water Meter as a Sanitary Agent," by M. N. Baker, C. E., New York city; "State Legislation and Municipal Sanitation," by Prof. O. H. Landreth, C. E., Schenectady, N. Y., which were read Wednesday afternoon and evening and Thursday morning. Mr. Steece's paper will be given later with its accompanying diagrams, also Mr. Landreth's.

THE NEW SEWAGE DISPOSAL PLANT AT MADISON, WIS.

By Prof. F. E. Turneaure, City Engineer.

The city of Madison has now been struggling with the problem of sewage disposal for nearly ten years. The natural outlet for the city drainage is into one or the other of the two small lakes which are adjacent to the town; and in the construction of the older sewers these lakes were freely used for sewer out-falls. The lakes are, however, very shallow near the shores, and during the summer are stagnant for many days at a time so that sewage discharged into them is diffused very slowly and a nuisance along the shores, from time to time, caused the question of purification to be agitated, and, after much discussion, the city adopted a plan whereby all the sewage would be collected and brought to one point and there treated by a system of combined chemical precipitation and sand filtration. The effluent from such works would be discharged into a small sluggish water-course leading from one lake to the other. Under these circumstances it was considered desirable to secure a fairly high degree of purification, although it should be said that neither lake is used as a source of water supply.

Before the above mentioned plan was adopted the feasibility of sand filtration alone had been quite thoroughly discussed, and ultimately rejected, on account of the high first cost and scarcity of suitable land, although not all those competent to judge were agreed upon this decision.

Shortly after the adoption of the combination plan the American Sanitary Engineering company of Detroit, Mich., presented to the city a proposition for the construction of a plant involving the use of ferozone as a chemical precipitant, and polarite as a filter, these being patented materials which this company controlled. They offered very high guarantees as to the purification which their scheme would effect and also guarantees as to cost. The proposition was accepted and the company put under bonds to carry out the terms of their contract. The plant was duly constructed and put into operation about June, 1899.

It will be unnecessary to enter into a detailed description of these works. It is sufficient to say that they consisted of a series of four chemical precipitation tanks of a combined capacity of about 200,000 gallons, and three polarite filters of a combined area of about 5,500 square feet, or about ⅛ of an acre, designed to filter the effluent from the precipitation tanks. The machinery connected with the plant consists of three gasoline engines of 12-horsepower rated capacity each, two centrifugal sewage pumps, a sludge pump, sludge press, chemical mixer, small centrifugal pump for pumping chemical, small rotary pump for pumping water for washing filter beds, and a dynamo. The precipitation tanks and filter-beds were constructed by the Sanitary Engineering Company; the pumps and other machinery were built by the city.

The results of operation which the plant was guaranteed to accomplish were briefly: That the effluent should be as good as would be produced if treated in the way previously adopted; that it should equal in purity the waters of Lake Mendota as shown by a certain analysis; that the cost of operation should not exceed $3,600 per year for 600,000 gallons of sewage per day, and that the effluent should not contaminate the waters of the lake, and that the plant and effluent in general should be satisfactory. The capacity of the plant was to be 1,200,000 gallons per day.

The failure of the plant to meet the terms of the guarantee is probably well known to most of those present. The chemical tanks did quite satisfactory work, although the amount of chemical required was very high. The filters accomplished relatively little. They clogged up rapidly and even though cleaned about once in three days their capacity was not more than three or four hundred thousand gallons per day. The cost of operation, including the necessary pumping, was at a rate of about $10,000 per year. The plant was not accepted by the city and litigation is now pending with reference to it.

As the city could not continue to operate this plant, and as the discharge of crude sewage into the lake could not long be permitted, it was necessary to construct a new plant of some sort without delay.

Prof. J. B. Johnson, dean of the Engineering College of the University, proposed, as the best solution of the problem, the construction of a plant involving the use of a septic tank and rapid filter, his opinion being based largely upon the experimental work at Manchester, which had just then been made public. With this opinion the writer

STONY BROOK CHANNEL AT ENTRANCE OF BOYLSTON AVENUE BRANCHES, BOSTON, MASS.

fully concurred, and, after considerable public discussion, he was called upon to recommend detailed plans. In deciding upon the general arrangement it was considered that some kind of filters would be required in addition to the septic tank, but that the purification need not be so great as would be obtained from the ordinary sand filter. The plans therefore contemplated septic tanks and coarse filters. The plans were authorized first and construction begun upon them in March last. They were completed and put into operation about Aug. 1. The filters were not authorized until some months later and construction of this part of the plant is now progressing. It is expected that sufficient filter area will be completed by Nov. 15 so that the dry weather sewage can all be filtered. When this paper was promised your society is was expected that the entire plant would be in operation by this time, in which case, more valuable data could have been presented. It will therefore be necessary to limit the paper to a description of the plant.

Madison has a population of about 20,000, about half of which is tributary to the sewers. This proportion is, however, rapidly increasing. About 160 roofs are connected with the sewers and 340 cistern overflows. The consumption of water is about forty-five gallons per capita, and the ordinary dry weather flow of sewage is about 450,000 gallons per day. In wet weather the flow is increased to about six or eight hundred thousand gallons, due to inflow of ground water; and after heavy rains the discharge rises to 1,000,000 gallons or more for a short time. As would be expected from the low water consumption the sewage is of a fairly strong character. The albuminoid ammonia usually ranges from about 0.8 part to nearly 2 parts per 100,000, and free ammonia from 1.2 to 3.6 parts. Ordinarily about three-fourths of the albuminoid ammonia is in suspension, a condition which may be considered favorable. The sewage is, however, not readily cleared by sodimentation, owing to the fact that in passing through the pumps the suspended matter is thoroughly stirred up and is left in a state of very fine subdivision.

In fixing upon the design the matter of economy of construction had to be kept prominently in mind, as the city had already paid out about $25,000 toward a disposal works, in addition to the amount expended for the pumping station.

The pumping station and disposal works are located on the low marsh land in the eastern end of the city. The main outfall sewer carries the entire sewage of the city by gravity to this point, discharging it into a well at a depth of about fifteen feet below the surface. From this well the sewage is raised by centrifugal pumps. In the design of the tanks it was necessary to build them practically on the surface of the ground in order to permit the sewage effluent to pass by gravity onto the filter bed. It was also desirable to have the filter beds as shallow as possible. In fixing upon the capacity of the tank the sewage flow was assumed to be about 600,000 gallons per day, and the tank capacity was taken at 400,000 gallons, thus permitting sixteen hours' average sedimentation, but nearly twenty-four hours for the dry weather flow at the present time. A fairly long period of sedimentation was considered desirable on account of the fine character of the suspended matter, but it was thought that larger tanks than the above would offer very little advantage. In the writer's opinion the danger of septic poisoning of the sewage by a too long period of rest can largely be avoided by the use of long and comparatively narrow settling tanks. It would appear, for example, that a tank might be indefinitely long, provided the velocity of flow is such that the cleared sewage will pass beyond the area of excessive bacterial action in the sludge before objectionable products of decomposition have had time to form. It certainly seems reasonable to suppose that the effluent from an efficient tank might be passed on through a great length of similar tank or a series of tanks without detriment. If this theory is correct the critical point to be determined in a design of long rectangular tanks is the proper velocity of flow so that the sewage will not remain in the region of excessive bacterial action too long a time. From these considerations it was thought that a long tank was the safer form of construction. The depth of a tank, within quite wide limits, would not seem to be very material as many experiments on sedimentation have shown that the effect of depth is not great. In this case the depth was determined largely by considerations pertaining to convenience of construction. The tanks as finally constructed consist of two simple rectangular reservoirs, each 30 feet by 120 feet inside dimensions. The depth of sewage varies from 6 feet at the outlet end to 8 feet at the inlet end. The walls are built of Portland cement concrete founded on a layer of clean sand about three feet below

the surface. They reach to a hight of about nine feet above the original surface and are backed by earth embankments which reach within one foot of the top of the walls. The level of the sewage inside is the same as that of the earth embankment. The tanks are covered with an ordinary tar-and-gravel roof placed close to the surface of the sewage. Numerous openings, covered by simple board covers, permit access to the tank for cleaning and inspection, and for the adjustment of certain baffle boards used for holding back the surface scum. The floor of the tank consists of four inches of concrete resting upon compacted clay. Sewage is pumped into the tanks at one end through a cast iron force main, which is divided into eight branches where it enters the tank at an elevation of four feet below the surface of the sewage.

Each branch ends in a bell mouth, where it passes through the concrete wall. By this arrangement the sewage is well distributed along the end of the tank and enters at a low velocity so that sedimentation can begin promptly. The effluent passes out at the opposite end of the tank over a weir extending the entire width of the tank. To prevent the scum from passing off a number of baffle boards are used and three of these are placed quite close to the outlet weir. After passing over the weir the sewage flows along a channel in the wall to an outlet pipe and thence either to the filter beds or directly to the outfall. Provision is made for cleaning out the accumulated sludge by depressing one end of the tank and providing there a sump connecting with a sludge pipe which leads to the old sludge well at the pumping station. The sludge can then be pressed, or, if desired, pumped into tanks and carted off, all the necessary machinery being already installed. The two tanks are arranged side by side and both are in continuous operation, the object of making two tanks instead of one being merely to permit of cleaning without interrupting the operation. The contract price for the tank and piping was $7,020. This was higher than it would have been had the contract been let in the summer, as the specifications provided for winter work, involving considerable extra expense.

In the design of the filters there was a choice of many different schemes and combinations. It was at first contemplated to use the ordinary contact beds with possibly double contact. Such an arrangement, however, would have required the construction of water-tight reservoirs and would have been quite expensive. With further study it was concluded that the coarse filter operated intermittently like an ordinary sand filter would possess considerable advantage; that is to say, a filter in which the sewage is applied intermittently by sprinkling or some like method, and where the pores are never entirely filled with the liquid. Available data, including the results of certain experiments carried out at this place, indicated that such filters would be likely to effect a better nitrification, and, furthermore, they would not need to be water tight, nor have any division walls whatever. The only difficulty with this system is in the design of an effective method of distribution. After considering several schemes the following arrangement was adopted: A bed of an area of one acre was fixed upon as the desirable size. This bed is arranged in two stories or two beds, each about two feet thick, to be composed of screened locomotive cinders. The lower bed is placed upon a floor of inch boards laid upon the ground and having wooden drains constructed therein 1 ft. apart. The boards are used on account of the soft character of the soil on which the filters are built. This bed is composed mainly of cinders from 3-16 to ⅜ inches in diameter.

At the bottom is a thin layer of coarser material. The upper bed is supported twelve inches above the lower bed on a floor of hemlock boards 2x4 inches, laid with a ¼-inch space between; 2x6-inch joists, resting on 2x4-inch posts, support this floor. The upper bed is composed mainly of cinders from ⅜ to 1 inch in diameter. The sewage is distributed over the upper bed by means of 3-inch perforated vitrified pipe, laid two feet apart. The entire bed is rectangular in shape, 140 feet by 300 feet in size. There are no division walls or embankments, but exterior embankments of earth and rejected cinders are constructed to retain the filter cinders and furnish room for a drive or footway. The distributing system is divided into seven sections, each covering a space of 140x40 feet and supplied with sewage by an independent pipe. In each section the main distributing pipe runs through the center and from it branch the lines of 3-inch pipe, each 20 feet long. These are perforated along the top with 5-16-inch holes spaced one foot apart for the escape of sewage. These three-inch pipes are laid on 2x6-inch plank, embedded in the cinders, and are

surrounded with cinders up nearly to the holes at the top. The lines of pipe are then covered with 1x8-inch boards placed an inch or so above the pipe. The whole is then covered with fine cinders or other cheap covering to a sufficient depth to prevent freezing. The sewage will escape under a head of from two to six inches and by striking against the board covering will be somewhat scattered thereby. Immediately around and under the distributing pipes the cinders will be finer than underneath, in order to aid in distributing the sewage. While this arrangement will not, of course, give a perfect distribution of sewage on the upper bed, it will be fairly good, and it is believed will be all that can be desired on the lower bed. There will also be good aeration between the beds.

The method of operating the distribution system remains to be described. Between the septic tanks and filter beds is placed a receiving chamber of a capacity of about 500 gallons ,or about five minutes' flow from the tanks. From these chambers pass the separate pipes to the seven sections of the distributing system, each having a separate valve. Assuming the chamber full, one of the valves is opened and the contents, together with the sewage which enters in the mean time, are discharged quickly and with considerable head upon the one section of the bed. The valve is then closed and the tank allowed to again refill, when another section is closed, etc. By varying the operation of the valves the sewage can be applied as often as desired. By this means, concentration of discharge is secured, which permits the use of good-sized holes in the distributing pipes, and at the same time gives considerable pressure head so that small irregularities in construction will not materially affect the distribution. Split pipe, or troughs would obviously be of no use for distributers in this form of filter. The covering of cinders above the pipe will, it is believed, obviate any trouble from odors due to gases liberated from the sewage as it is applied to the bed. The valves of the distributing pipes will be of the butterfly pattern, and will be operated from the pump house by means of wire cables. Automatic operation will be secured by a mechanical device attached to the pumping engines. Provision will be made for flushing the 3-inch distributers by connecting them in groups of seven to a six-inch cross pipe provided with a simple wooden gate valve. Ventilators reaching down to the interior air space will be so arranged as to cause some circulation of air in the bed; and manholes placed over the drains will permit of taking samples from any section.

The cost of the filter bed is about $7,500, the city to furnish the cinders f. o. b. at Madison. The estimated capacity is about 1,000,000 gal. per day, or at least 50 per cent. more than the present volume.

The tanks have now been in operation about six weeks and appear to be in good working order. A good scum formed within two weeks. The effluent appears to be of about the same character as the sewage, but with much less suspended matter. It was expected to present here an analysis of the effluent, but the sampling was postponed until last week and it then proved to be impossible to get the work done.

Some notes regarding the experiments already referred to which were made here last winter may be of interest. These were conducted by University students as a thesis study. A septic tank was used which consisted of an ordinary barrel, into which sewage was introduced at hourly intervals. Two styles of filters were used. A single contact bed operated on the fill-and-draw principle and a double intermittent filter arranged in the same way as that adopted for the large plant. The cinders used were from ⅛ to ¼ inch in diameter. All filters were 2½ feet deep and were operated at a rate of 500,000 gallons per acre per day. The septic tank was started in July, 1900, and the filters in November. Analyses were made at frequent intervals from December, 1900, to April 26, 1901, with the following results for the months of March and April, the last months of the experiments. The average improvement by the septic tank, based on the albuminoid ammonia was 62 per cent. That by the tank and the upper bed of the double filter was 76 per cent., and practically the same by the single contact bed, and by the tank and both of the double filters, a total of 87 per cent. There was practically no nitrification established in the contact bed by the end of the experiment, although in the effluent from the other filters the nitrates reached .6 part per 100,000.

The average analysis of the sewage was:

Free ammonia	.98 parts per 100,000
Albuminoid ammonia..	.51 parts per 100,000
Oxygen consumed	14. parts per 100,000

The effluent from the double filter was very clear and odorless and would not undergo any putrefaction by standing six weeks in a room at a temperature of 700 degrees F. A bacterial analysis showed that with 5,000,000 bacteria per c. c. in the

ADAMS STREET CULVERT OVER DAVENPORT BROOK, BOSTON, MASS.

sewage the septic tank effluent had but 3.5 per cent. of this number and the filter effluent only 0.6 per cent. The depth of sludge remaining in the septic barrel after ten months of operation was only 1.3 inches. The weight of the solid matter in this was estimated at 0.7 pound, while about 15 pounds had been delivered to the barrel.

It is thought that the large tanks will do fully as well, being of a better form for sedimentation. Whether we have adopted the very best form for a filter is, of course, an open question. The working of the entire plant will be carefully followed, and in addition it is planned to conduct experiments on several different forms of filters for a number of years, applying to them the effluent from the septic tank. In this way the maximum capacity of the present plant can be experimentally determined without endangering the life of the plant itself, and much valuable data accumulated for use when extensions are needed.

ENGINEERING PHASES OF THE WORK OF MUNICIPAL BOARDS OF HEALTH.

By Marshall O. Leighton, Consulting Expert, Montclair, N. J.

It is generally admitted that a board of health should have control over matters which are effective in the maintenance of public health. This means that the supervision, maintenance and regulation of public systems, which have been established by reason of an hygienic necessity should be vested in that body. Unfortunately, such is not generally the case. The legislatures of different states have delegated to separate municipal bodies the administration of matters which are wholly within the sanitary province. In one state it is the regulation of plumbing construction; in another it is the collection and disposal of garbage; in a third it is the milk supply and so on until retrospection shows that there is little uniformity in the powers and precepts of boards of health in the different states and provinces in this hemisphere.

A glance over various laws in some of the representative states of our union will reveal certain engineering duties which are thrust upon municipal boards of health. It is apparent at once that the regulation of plumbing, drainage and ventilation are included within the powers of many boards, and that these powers do not extend simply to the framing of regulations concerning those subjects, but involve a thorough knowledge of them from the engineering standpoint so that intelligent inspection of work may be accomplished and advice given concerning the correction of defective systems.

In New Jersey an act was passed in 1888 reading partly as follows: "Section 12—That the said local boards of health shall have power to pass, alter or amend ordinances and make rules and regulations in regard to the public health within their several jurisdictions for the following purposes:

"VIII—To secure the sanitary condition of tenement houses, jails, prisons and all public buildings."

A supplement to this law reads as follows: "That local boards of health, except township boards, shall, in addition to the powers enumerated in the act to which this is a supplement, have power to pass, alter or amend ordinances and make rules or regulations within their respective jurisdictions:

"1. To compel, prescribe, regulate and control the plumbing, ventilation and drainage of all buildings, public and private * * * and require plans with necessary drawings or descriptions to be submitted to said boards for inspection and approval.

"11. To secure the sanitary condition of all buildings public and private."

The health laws of Ohio give to municipal boards the following power: "When any building erection, excavation, premises, business, pursuit, matter or thing or the sewerage, drainage, plumbing or ventilation thereof is in the opinion of the board of health dangerous to life or health * * * the board of health may declare the same a public nuisance and may order the same to be removed, abated, suspended, altered or otherwise improved * * * and the refusal or neglect to obey such orders shall be a misdemeanor punishable as hereinafter provided."

In Wisconsin the law reads, "Every board of health may take such measures and make such rules and regulations as they may deem most effectual for the preservation of public health." This is probably the broadest statute defining the powers of a local board of health which we have in this country and its application can be extended to

include engineering work of almost any character. The omnibus term "dangerous to public health" is an expression which gives almost limitless powers, is defined only by a concert of eminent authorities and can be expanded to fulfill conditions and circumstances most convenient in the carrying out of sanitary work.

In a model ordinance carefully drawn up by the State Board of Health of Illinois to conform with statutory limitations and examined and approved by eminent legal opinion we find the following in Article III, Section 1: "That whenever it shall come to the knowledge of the board of health or of its officers or employes that the condition of any building or premises is injurious to the health * * * it shall be the duty of the medical health officer or sanitary policeman to make a thorough examination of the building and to direct and instruct as to the remedy of such condition."

Again in Article VIII, Section 1, "To make regular inspection of all school buildings and premises as to their hygienic condition and report * * * with instructions as to the remedy of conditions (if any are found) whereby the health of those in attendance may be impaired or life endangered."

These brief quotations from the laws for a few of our states show, to some extent, how wide are the possibilities for engineering works in boards of health. It may be pertinent to discuss briefly a few of the branches which are taken up by some of the most representative health boards.

The most familiar engineering work of a board of health is the regulation of plumbing. In some places the rules covering this are extended to embrace the sewerage system itself; in others the house laterals from the sewer to the house-tops are included, while there remain codes which seek to regulate only the construction inside the basement wall. When cesspools or local systems of sewage disposal are constructed I believe it is always the case that such construction is under control of the health board.

Physiological research has shown that the air from sewers is not the deadly poison that it was once supposed to be. Indeed, it has been demonstrated that the air from some sewers which are in constant use is far more wholesome than that lying over some streets or confined in some houses. These observations have not, however, resulted in any relaxation of efforts to improve plumbing. While it is extremely doubtful if specific diseases are transmitted by means of defective drains it is manifest that it may have predisposing effects upon those receptive individuals who compose the greater part of the population. Good plumbing is none the less desirable and necessary because poor plumbing has been found to be less deadly than has been popularly supposed.

The greatest need in the regulation of plumbing is uniformity of requirements among the municipalities of the country. A glance over the plumbing codes of various cities shows that ideas of proper construction differ widely. In many places the principal object seems to be to make the plumbing as complicated and expensive as possible. There has arisen among sanitarians a terror of a common physical phenomenon called syphonage, and the apprehension which it causes has led to the establishment of regulations which, when carried out faithfully, make of what should be a simple, carefully aligned system nothing more than a labyrinth of iron and lead pipes which violate every principle of good mechanics. One board finds a special danger in the use of a certain device, while another sternly demands that it be used on all occasions; a third will rest secure in the existence of a "main house trap," while a fourth will tolerate it under no circumstances. So we may pass from one code to another until we wonder how a mechanic can work intelligently in more than one town.

Coincident with uniformity, we hope for common sense. It is very rare in any work that a hard and fast method of procedure can be made to apply to every case. Rules of construction, however rational and practical they may seem at outset, must be modified to a greater or less extent in actual practice. Here it is that a board of health must stand in the position of consulting engineer. It becomes necessary to determine each course to be pursued in each of the cases dealt with and naturally the board becomes the court of appeal. Too often, I may say, this court is impractical; it is bound by theories which have never been properly applied, and prejudices which will not stand the test of close observation. A commission of qualified authorities which would examine into the practice of plumbing, throw into discredit some of our false notions, and place before us a rational plumbing code, would render great service to those who are seeking the advancement of municipal improvement.

In our older, thickly settled cities, the

question of drainage was settled before boards of health took the place which they now occupy. In suburban quarters, especially those with no system of sewerage, health boards are called upon to deal with important drainage questions which are distinctly engineering in their character. It is generally the law that systems of sewage disposal for single houses must be constructed in a manner satisfactory to the local sanitary authority. This is proper and necessary, for without it we find that cesspools are set in swamps, overflow pipes in the drainage area of wells and private sewers laid without regard to grade or outlets. Some one in authority must know how certain systems are adapted to certain soil, how filtration may be affected by local conditions, and be versed in many other matters, in order that the boards which he represents may adjudicate wisely in each individual case. The regulation of plumbing then, must carry with it a presupposed insight into many important engineering questions.

The drainage of wet, rotten and spongy land, and the divergence of surface water from places in which it does damage to other and proper courses is often a perplexing problem for boards of health to meet. The Massachusetts law gives local boards power to drain such lands if the expense therefor does not exceed the sum of $2,000. Such work is purely that of an engineer, and yet it often becomes the duty of a board of health to perform it.

Problems of heating and ventilation occupy the attention of many health boards. Whatever else may be at issue, I think it has been thoroughly admitted that no settled method of procedure will be successful in all cases. The peculiar conditions attending upon each special case make it necessary that the board of health should have a thorough insight into the minute questions of ventilation. Excellent work along these lines has been performed in various cities under the direction of boards of health, notably in Washington, D. C., by Dr. Woodard, health officer; in Providence, R. I., under the direction of Dr. Chapin, superintendent of health, and in other well-known localities. The work done with reference to school ventilation has been extremely beneficial from every point of view, and the determination of the best method for ventilating schools has been materially advanced thereby.

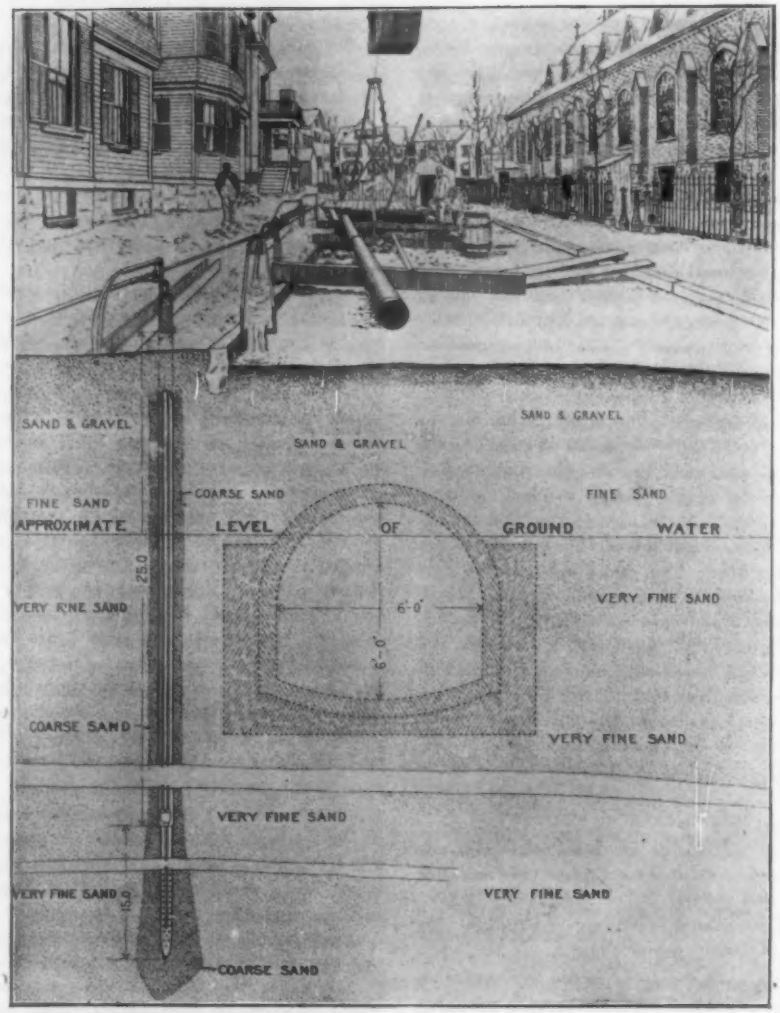
The abatement of nuisances brings out numerous engineering problems which require intelligent treatment. It is necessary for the sanitary authorities to have proper ideas concerning the remedy for each nuisance, and to intelligently pass upon plans brought forward for their abatement. A foul industrial odor may pollute the air of a neighborhood, or the smoke from a factory may be a damage to health and property. It is first necessary to ascertain whether or not such a nuisance is amenable to treatment, and, although it may not have the duty of prescribing the means by which it may be abated, it must, nevertheless, have a clear understanding of how relief can be obtained in order to properly pass upon the effort made in that direction.

Engineering work falls to the lot of the board of health in connection with garbage disposal. In the majority of cases in large cities the actual work of selecting a particular kind of disposal works and the maintenance of the system is delegated to a special department. In such cases, however, it seldom fails that the health authorities are consulted in the beginning and have a powerful influence in guiding the trend of affairs in the inauguration of a system. It is very seldom, indeed, that the counsel of a competent board is disregarded in such a preparation.

Having established the system it is true that in numerous notable cases the management is given over to the board of health. When this is not the case the sanitary control of the collection falls under the guidance of the health board. We have seen many instances in which a board has been called upon to pass upon the merits of systems in use by reason of complaints from citizens living in the vicinity of the disposal works. This is a grave responsibility which must be dealt with wisely. Having a system in operation for which the municipality has paid full value, it remains for such board to determine whether the system is or is not a proper one. The first step, that of determining whether a nuisance is present, is not an engineering question, but having determined that such is the case, the question of abating it without actually abolishing the whole system makes it necessary that the available information concerning garbage plants be at the disposal of the board.

In smaller municipalities the inauguration of the whole system is often put in the hands of the board of health.

These remarks apply also to a large extent to the establishment of systems of water supply and sewage disposal.



METHOD OF LOWERING GROUND WATER, GOLDSMITH BROOK CONDUIT, ST. JOSEPH STREET, BOSTON, MASS.

THE WATER METER AS A SANITARY AGENT.

By M. N. Baker, New York City.

The value of the water meter as an aid in husbanding scanty water supplies and postponing the day when additional pumps, larger mains and more capacious reservoirs will become imperative is fully appreciated by most water works men. Members of the same class, as a rule, also appreciate the fact that the water meter is the most equitable and reliable means of apportioning the cost of public water supplies between private consumers. But neither water works superintendents nor any other class of city officials have more than begun to realize the possibilities of the water meter as an aid to sanitation. As for the general public, and even large numbers of health officers and other sanitarians, the water meter is commonly looked upon by them as a sanitary evil rather than a sanitary necessity. In fact, nearly every one who has introduced or tried to introduce the meter system knows only too well that the strongest opposition encountered often centers around the plea that meters are a menace to health because they cause people to skimp in the use of water. The weakness of this and other assertions that meters are unsanitary has been repeatedly shown, but so far as I am aware no one has considered the water meter from the single standpoint of its beneficial relation to the public health.

The chief sanitary benefits which result from the use of water meters are:

1. Pure water supplies.
2. A wider and freer use of public water supplies.
3. The extension of sewerage systems and their introduction into the smaller cities and towns.
4. More money rendered available for other sanitary improvements.

1. The need for purer water can scarcely be overestimated. Typhoid fever alone, a large percentage of which is due to impure water, claims its thousands of lives every year. Besides this disease many other minor ailments and much poor health are due to unwholesome water. The indirect damage to health resulting from water which is so muddy or otherwise unpleasant as to discourage rather than encourage its use for bathing purposes cannot be estimated.

The rapid increase in water consumption on the one hand and the equally rapid pollution of water supplies on the other renders the problem of securing pure water more difficult every year. The growing appreciation of the dangers of polluted water supplies, welcome as it is, adds to the perplexities of those charged with the administration of water-works plants. As the consumption and waste of water mounts up, the choice gradually narrows to some distant source of supply or the purification of water from some near-by source. Even if the former is chosen the chances are that sooner or later purification will be required.

The greatest obstacle to any improvement in the character of water supplies, whether by purification or going further afield, is the large volume required to meet present demands and the far greater quantity that must be provided to keep pace with the increasing use and waste. The consensus of opinion on the part of all who have given careful attention to the subject is that waste, not use, is chiefly responsible for the leaps and bounds in water consumption and that the waste may be curtailed, often to the extent of cutting the total consumption in half, by the use of meters. If this be true, and I am firmly convinced that it is, then the water meter may be made one of the most efficient sanitary agents of the century. Its universal introduction would go far toward solving the problem of providing pure water to every city dweller in the country.

Incidentally the meter system would aid in the struggle for pure water by diminishing the amount of sewage and thus simplifying and cheapening its final disposal without polluting some water supply. This in itself is a strong argument in favor of the use of the meter.

2. A wider and freer use of public water supplies would follow the universal meter system. The reduced cost of the smaller supply, both in construction and operation, would make works feasible in many places now without them and would aid in extending existing plants to sparsely settled districts. In all except the larger cities of the country there are many people living on streets provided with water mains who continue to use private wells, often badly polluted, rather than pay a yearly rental for water. Reductions in this rental, made

possible by the use of meters, would encourage the abandonment of wells.

In addition to the foregoing considerations, and in some respects still more important, the meter system would extend the use of water by people of moderate means and by the very poor, many of whom under schedule rates have access to but one faucet for drawing water. That faucet is located over the kitchen sink or in some common hallway or yard. Cold water is all that can be drawn from it, which materially lessens its use for sanitary purposes. Now, meters not only tend to lower water rates through the saving in water already noted, but they make possible a complete readjustment of the cost of water service, First they make it easy to place the cost of fire protection, street sprinkling and water for public building in the general tax levy, or to assess it upon the real and personal estate and the several public departments directly benefited. This would naturally lessen the portion of the cost of water service which would fall upon the private consumers. The water meter would then distribute the cost of private service, not according to the number and kind of plumbing fixtures a family happens to have, but in proportion to the actual amount of water which it uses and wastes. By means of this reduction and equalization of the cost of domestic service a family which, under fixture rates, could afford only a cold water faucet at the kitchen sink, might under the meter plan at no additional expense have a bath tub and other fixtures with hot and cold water and perhaps a water closet beside.

3. The relations between water supply and sewerage are so intimate that what favors the introduction of one ought always to favor the others as well. All small, and an increasing number of large, towns are being sewered on the separate plan—that is one set of conduits removes household wastes, or sewage proper, and (but often not till years later) another set is provided for the removal of storm water. Obviously, the less the water consumption the less will be the sewage and the smaller may be the pipe system. If the sewage is either pumped or purified any decrease in amount is doubly welcome. The net effect of the use of meters on the sewerage system is to reduce its cost, and thus to make it more readily available to all cities and towns and to all the people in each city. The introduction of sewerage systems, and their use after being introduced, is far less general than is the case with public water supplies. Moreover, many people defer water connections until sewer connections can also be made on account of the well-known cesspool nuisance. The sanitary benefits of sewerage connections with the abolition of privies and cesspools are too obvious to need exposition here.

4. Thus far the water meter has been considered in relation to the public through the water works and sewerage systems. Important as these facilities are, it should not be forgotten that every dollar that can be saved through the use of meters is urgently needed for the sanitary betterment of the city in other particulars. Water supply, very properly, has always ranked first among municipal public works. But hundreds of American cities are spending money in a vain struggle to keep pace with increasing water consumption and waste, which, under a proper meter system, would be available for such sanitary needs as improved methods of sewage and garbage disposal, sanitary pavements, healthful school buildings, efficient health board work, and ample parks and play grounds.

Mr. Baker's paper gave rise to considerable discussion. The reversal of the position of the ordinary citizen who condemns the water meter as unsanitary is so frank and so complete that it gives its readers most excellent arguments in a discussion with the citizen or official who is ignorant as to the facts and bases his statements on partial reasoning from insufficient data. Mr. Sherrerd reported a reduction of 30 per cent. in consumption by metering 10 per cent. of the taps. Mr. Brown reported particular cases of saving to both consumer and municipality, and suggested a case or two in which meters would not result in sufficient saving to the system to pay the interest upon their cost and the repairs and renewals.

The Committee on Disposition of Garbage and City Cleaning, John Jones, chairman, reported further work upon the same lines as last year, and presented the same list of questions for discussion. Although the disposition of city refuse is perhaps in the most unsatisfactory condition of any branch of city sanitation, there was not enough interest in the subject, or not enough hope of new ideas, to induce any discussion. A paper upon the utilization of garbage in the production of steam was promised, but the experiments are not yet far enough ad-

vanced to warrant any statements as to their ultimate success or failure, so the paper was not forthcoming. Mr. John H. Emigh, city engineer of North Adams, Mass., sent a paper on "The Collection of Garbage and Street Cleaning," which was read by the secretary. It gave a general view of the present conditions, but offered no hints or hopes of improvement.

The report of the Committee on Review, N. P. Lewis, chairman, was a valuable contribution to the literature of the convention. It was read on Wednesday evening.

REPORT OF COMMITTEE ON REVIEW.

N. P. Lewis, Chairman, Chief Eng. Dept. of Highways, Brooklyn, N. Y.

Your committee on review, feeling that the last three reports of this committee have covered the cities of this country very thoroughly, will not attempt a systematic review of the progress of city work as indicated by various municipal reports, but will in a very general manner comment upon some of the most noteworthy improvements under way, upon some of the general tendencies in methods and systems and upon a few of the most conspicuous changes in laws relating to the administration of the affairs of cities. Nor will we attempt to confine our observation to the cities represented in this society, reports from which are most likely to be discussed at our meetings, and we may possibly be thought to have neglected them to comment upon the affairs of municipalities which have thus far honored neither the society nor themselves by sending delegates to our conventions.

The attention of one looking over the general field of municipal work is attracted by the fact that larger sums than ever before are at present being expended for municipal purposes. In the city of New York there is under contract and process of construction a transit system which is to cost the city $35,000,000, while an extension of the system by tunnel under the East river to and through a part of the Borough of Brooklyn at an additional estimated cost of $8,000,000 has been authorized, and surveys and plans are now being prepared preparatory to the making of contracts. So much has already been printed about this great work that it is needless to take time by giving even a general description of it. Nearly all of it will be beneath the street surface and will be built by the cut and cover method, though there are several tunnels and one or two viaducts. The streets which it will traverse therefore are and will for some time to come be in a chaotic condition. The building of this rapid transit road is the result of years of agitation and persistent effort. It has been violently opposed as a poor business venture by the city or as an effort to present to some corporation not only a valuable franchise, but a railroad built at public expense. The city is paying the first cost of construction, and the contractor is to equip the road, furnish the power and operate it for a period of fifty years, which may be extended for twenty-five years, and is to pay the interest on the bonds (which is 4½ per cent.), besides 1 per cent. annually for a sinking fund with which to pay the bonds at their maturity, when both road and equipment, with power houses and all appurtenances are to become the property of the city. Considering the inevitable consequent development of outlying portions of the city, which cannot now be reached within an hour, and at no time with comfort, it cannot be doubted that the investment will prove a profitable one. The operating contractor or corporation is permitted to use the city's credit, securing the capital for construction at a very much lower rate than could have been possible to a private corporation, it will be exempt from taxation, have no paved streets to care for, nor obstructions to limit its speed in operation or invite accidents; will have no damage suits to defend for obstruction of light and air as have had the elevated roads, and no legislation can compel it to charge less than five cents for a ride within the city limits for 75 years to come. It will seem, therefore, that both parties will find the enterprise profitable. The establishment of closer lines of communication between the different parts of the city seems to be the one great ambition of New York at present, for in addition to the millions being expended upon the rapid transit systems, one great suspension bridge across the East River is now well under way, which, including the purchase of property for approaches, will cost about $18,000,000, while work has been commenced upon two others, one a suspension bridge between the old Brooklyn bridge and the one just

referred to, which it will about equal in cost and the other a truss bridge connecting the Boroughs of Manhattan and Queens with two piers resting upon Blackwell's Island, and the total cost of which is estimated to be about $12,000,000.

In addition to all this, the city is annually spending millions upon water front improvements, extensions of its water supply system, in purchasing and improving new parks and in repairing streets. The enormous expenditures for rapid transit and bridges, however, make it almost impossible to provide as much as is desirable for the last named improvements, though $2,000,000 annually has been allowed during the last few years for repaving. In this condition, it should be noted that the use of asphalt for repaving streets sustaining very heavy traffic is being carried to what may be called an extreme in the borough of Manhattan, where Broadway, from Fourteenth to Canal-sts., is being so paved and similar treatment is demanded and seriously considered for all of the remaining lower portion of the street. The price paid under the present Broadway contract is $5.69 a square yard for the asphalt wearing surface with maintenance for ten years, and 59 cents a square yard for relaying the present pavement.

This pavement and that on a number of other streets lately repaved with asphalt is granite block on a concrete foundation. The old blocks are taken up and laid flat on a sand cushion to form a foundation for the asphalt, the surplus blocks being delivered at the city repair yards.

The people of New York seem to have no further use for stone block pavements. Brick is not at all popular. Asphalt block is being laid as an original improvement, payable by assessment, on quite a number of streets. A recent and successful practice is to lay such blocks three inches in thickness directly in a bed of mortar placed on a concrete foundation. This construction is taking the place of that with four-inch blocks laid in a cushion of sand, and the cost is about the same.

In the Borough of Brooklyn, besides the extension of the Rapid Transit system already referred to, the tracks of the Long Island railroad, which occupy one of the principal streets for over six miles, are being removed from the surface by placing

N. P. LEWIS, Chief Engineer of Highways, Brooklyn, N. Y.

them partly in tunnels and partly on elevated structures. Toward the expense of this change the city is to contribute $1,250,000, the remainder to be borne by the railroad company, which will be enabled to connect directly with the new rapid transit system of the greater city. Aside from this, the most conspicuous work now under way in the Borough of Brooklyn is the building of several large sewers in tunnel, the maximum diameter being 13½ feet. The material through which these tunnels are being driven is nearly all coarse sand, with a few boulders, and the cost of building them is about $71 a running foot.

Brooklyn is also putting in a mechanical filtration plant for the treatment of a portion of its water supply which has recently shown signs of pollution.

Philadelphia maintained during the year 1900 its remarkable progress in the making over of a town famed for its conservatism into one of the most progressive cities. The report of the directors of public works shows that near sixty-eight miles of pavements were laid during the year, of which about 60 per cent. consisted in repaving old streets with improved pavement and 40 per cent. was new work.

Philadelphia now has over 1,090 miles of improved streets, of which 269 miles are sheet asphalt, 358 miles of granite block and 208 miles of macadam. The director claims that "the macadamized roads are unexcelled by any city in the union, and rival the famed roads of France." The record of sewer construction was also remarkable, over forty-four miles of main and branch sewers having been built during the year. Some of these main sewers were of large size and of unusual design, and are well illustrated in the report. The Pennsylvania-ave. subway and tunnel, begun in 1894, was completed and the street surfaces have been restored in a most substantial manner. The cost of this improvement, including engineering and incidental expenses and damages paid was more than $5,300,000. The report refers to the work of the "draughting division of the Board of Highway Supervisors," which is said to be more than self-supporting, and which is making complete plans of all sub-surface structures, which will be of great value and are being secured without cost to the city. No details are given, nor any hint as to how the office is made self-supporting.

There has been developed during the last few years a keen appreciation of the importance of the abolition of railroad crossings at grade. A special report upon the conditions existing at Cambridge, Mass., was issued on March 5 of the present year by Mr. Lewis M. Hastings, the City Engineer, and a member of this society. Mr. Hastings prefaces his report by some interesting statistics concerning work of this character recently done and now under way. Most conspicuous is the immense undertaking of Chicago, where 389 grade crossings had been done away with at the beginning of the present year at a cost of over $17,000,000, while 156 more are to go at an estimated cost of $6,558,000.

Large sums are now being expended in Buffalo by a commission of which Mr. Edward B. Guthrie, also a member of this society, is chief engineer.

The Pennsylvania railroad company in 1895 abolished twenty grade crossings at Elizabeth, N. J., by elevating its tracks, and at the same time eliminated a dangerous crossing of the tracks of the New Jersey Central railroad.

Along the lines of the New York, New Haven & Hartford railroad millions have been and are being expended for the same purpose. The Pennsylvania-ave. subway in Philadelphia has already been referred to. Mr. Hastings's report contains some excellent illustrations of work of this kind recently done, as well as plans showing clearly his own recommendations, the estimated cost of carrying them out being in round numbers $1,855,000.

The report of the City Engineer of Baltimore would indicate the passing of the cobblestone pavement even in that city, where it has so long been obtrusively in evidence, but one street having been paved with this material in 1900, while twenty-three streets were thus improved in 1899. The paving of streets by private contract seems to be unusually popular. The second report of the Sewerage Commission of the city of Baltimore is a particularly interesting one, containing not only a description of the local conditions, with the recommendations of the Commission, but also a valuable report on the bacterial treatment of sewage in England.

The present situation in St. Louis is peculiar. Owing to disagreements between the different branches of the city government no reports have been printed for three years, and it is only through the kindness of Mr. Robert E. McMath, president of this society, that your committee has been enabled to secure information concerning public improvements in that city.

It seems that in 1893 the state legislature

changed the laws governing local improvements in St. Louis, but after a delay of nearly two years the supreme court of the state decided the act making the change to be unconstitutional. Since 1877 the city has paid for all grading, and assesments for any improvement were limited to one-fourth of the assessed value of the adjoining property, the remainder being paid by the city. The charter was amended so as to make the entire cost of improvements assessable upon the property benefited, but this amendment was rejected by the voters upon submission to them in 1896. About the same time it was decided by some of the lower courts that the assessment of the cost of improvements according to frontage was in violation of the constitution of the United States. Under such conditions contracts for assessment work could not be let and local improvements practically ceased. It has lately been decided that methods of levying assessments can be determined by state legislatures and local authorities. Since 1877 the bonded debt of St. Louis has exceeded the constitutional limit of 5 per cent. of assessed valuations, so that no new bonds could be issued. There is now a prospect of relief. During the past year a number of street improvements were made. Vitrified brick seems to be the material most in favor for pavements, though granite is used for streets subjected to heavy traffic, and a number of streets have recently been paved with Kentucky rock asphalt by private contract. It is still too early for a verdict as to the success of this material. There is some dissatisfaction with the quality of the water supply, though the quantity is ample. The water is taken from the Mississippi a few miles below the mouth of the Missouri, and it was supposed at first that the water taken at this point was all from the latter river.

It is now found that the waters of the two rivers commingle at times to a considerable extent above the intake. While sedimentation of the water has always been provided for, filtration is now being urged, especially since the Chicago drainage canal has been in use. The securing of an entirely new supply is also advocated, and it is suggested that water be brought from the Ozark mountains by a conduit eighty-five miles long. Such a supply, claimed to be capable of furnishing 200,000,000 gallons daily, it is estimated, would cost $20,000,000, and it would also involve the abandonment of the present pumping plant, settling basins, conduits, mains and buildings, which represent an investment of $7,000,000. A commission has recently been appointed to consider the entire question of water supply.

The fourth annual report of the Board of Trustees, "Commissioners of Water Works" of Cincinnati, shows that at the beginning of the present year there had been expended upon the improvement of the water supply now under way, something over $1,265,000, and a large amount of work evidently remains to be done.

One always looks for something of interest and value in the annual reports of the operations of the engineer department of the District of Columbia, especially on the subject of asphalt pavements. That for the year ending June 30, 1899, contained a history of concrete and asphalt pavements in the district and a discussion of failures in asphalt pavements and their causes, both of which were valuable contributions to the literature of the subject. The report for the year ending June 30, 1900, contains an admirable paper on the inspection of asphalt pavements in Washington by Mr. A. W. Dow. These reports, while printed in the usual unpretentious style of the government printing office, contain much valuable matter.

In marked contrast to these reports in typographical features is that of the Street and Sewer department of Wilmington, Del., which is a model in this respect and contains a number of excellent illustrations. Pittsburg excels in the form and printing of its specifications for all work. The short paragraphs, conspicuously numbered, the logical arrangement, and the substantial binding with linen covers, render these specifications worthy of copy.

New Orleans, attractive and picturesque as it has always been, was until within a few years a notoriously badly paved city, and with its lack of a sewerage system the wonder has been that its sanitary record has been so good. All this is now being changed. An elaborate drainage system is being constructed, even a brief description of which could not be included in this report, interesting as it might be, owing to the peculiar conditions. Great progress was made during the last year in modernizing the city pavements, of which over twenty-four miles are now asphalt, while there are still nearly thirty miles of cobblestone and thirty-five miles of gravel.

The city engineer of Portland, Ore., states that the best of the city improvements are the sewers, and he hopes he

can see "the dawn of an era of better streets." The surface improvements most in vogue appear to be of macadam or gravel. The climate appears to be unfavorable to asphalt, though he believes that "on streets where the grade is sufficient to give good drainage, and with stone block or brick gutters, and where there are no car tracks or where the rails are solid, asphalt may be used here advantageously."

In his report for 1900 the city engineer of Syracuse makes a strong plea for an improvement of the sewerage system by the building of intercepting sewers, the drainage of lowlands in and adjacent to the city, and the proper and safe disposal of the sewage. Until this is done, he declares, the city can derive but partial benefit from its complete and expensive system of water supply, and delay in carrying out these much-needed improvements will add materially to their difficulty and cost.

St. Paul appears to be continuing its efforts to get rid of wooden sidewalks. The city engineer recommends the operation of municipal quarries and the purchase of a portable gasoline stone crusher, estimating that broken stone for repairs can be obtained in this way for about one-third of what it pays when furnished by contract. He also advocates the exclusive use of Portland instead of natural cements for concrete, and appears to think that this can be done without additional expense. His report contains the following: "Although it has received year after year the very closest attention from city engineers and others, it must be admitted that a cheap, durable, economical and sanitary pavement, one that fills the demands of the traffic of our large cities, has not yet been constructed. I think that engineers will agree that a pavement can be constructed that will fill all the above requirements except the one of cheapness. Such a pavement, I think, could be constructed for about $4 a square yard." While concurring in the first statement, we cannot but wish that Mr. Claussen had given some indication of the kind of pavement he had in mind which would solve the problem at $4 a yard.

While not strictly a municipal report, mention should be made of Bulletin No. 30 of the Department of Labor, issued in September, 1900, containing statistics of cities. In this report are given for 129 cities in the United States the date of incorporation, population, area, police, fire and vital statistics, areas of parks and of street pavements of various kinds, cost of street cleaning and garbage disposal, of schools and charities, of water supply, gas and electric lighting, amount of debt and assessed valuation of property and other information of great interest and value to all municipal officers, which is often wanted at short notice, and which is very difficult to obtain.

The changes which have taken place in the laws governing our cities equal if they do not exceed in importance the work actually done. Probably the most conspicuous of these changes is that in the charter of the Greater New York, which takes effect on January 1, 1902. The original charter, which went into effect at the time of consolidation at the beginning of 1898, provided a highly centralized form of government for a city of three and a half millions of people. The city was divided by natural boundaries into five boroughs of greatly varying size and population. Each one of these elected a Borough President. The entire city was divided into twenty-two local improvement districts indicated by numbers. The members of the Municipal Assembly resident in each of these districts constitute the "Local Board" of the district. All petitions for local improvements are presented to the Borough President, who is a member of all the local boards in his borough, and who calls the proper boards together to consider the matter, the department which would have charge of the improvement having at the President's request submitted a report with a detailed estimate of cost.

These local boards have power only to recommend important improvements to the Board of Public Improvements, though they can direct the flagging of sidewalks, fencing vacant lots and a few other unimportant things, but even in such cases the Board of Public Improvements must approve of their order before any work can be done. The Board of Public Improvements consists of a president, appointed by the mayor; the corporation counsel, the comptroller, the commissioners of the departments of water supply, highways, sewers, bridges, street cleaning and of public buildings, lighting and supplies, together with the five borough presidents, none of whom, however, has a vote except upon matters relating to his own borough. All surface improvements of streets, after being authorized by this board, must receive the approval of both branches of the municipal assembly before any contract can be made. Each of the departments is presided over

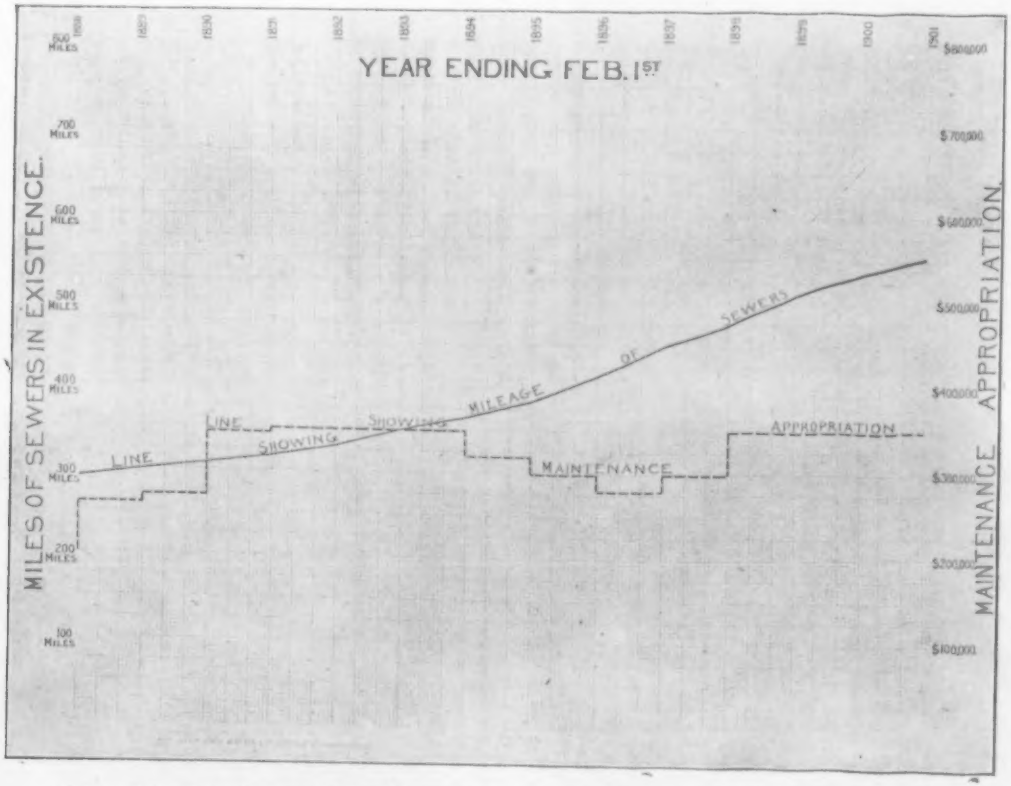

YEAR ENDING FEB. 1ST
MILES OF SEWERS IN EXISTENCE.
MAINTENANCE APPROPRIATION.
LINE SHOWING MILEAGE OF SEWERS
LINE SHOWING APPROPRIATION MAINTENANCE

DIAGRAM SHOWING MILEAGE OF SEWERS AND APPROPRIATIONS FOR MAINTENANCE IN BOSTON, MASS.

by a commissioner, and while there are deputy commissioners in each borough, these deputies have little if any power, so that, notwithstanding the elaborate machinery and the apparent desire of the framers of the charter to provide a certain measure of borough home rule, the results have only been to furnish a large amount of red tape, resulting in delays which have greatly exasperated the people who wanted improvements and were willing to pay for them, while their own borough officers were unable to help them. In response to demands for a change in the law a charter revision commission was appointed by the governor in 1900, and their recommendations were in 1901 enacted into law, which will take effect at the beginning of the next year. It is confidently expected that the revised charter will furnish a fair degree of borough autonomy.

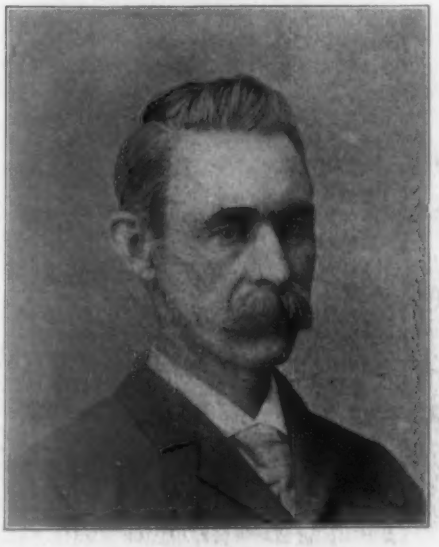
The borough presidents, instead of useless ornaments, will become officers of great power and responsibility, as they will combine many of the executive duties of the former mayors with the administrative functions of the usual commissioners of public works. While a borough president may appoint commissioners or superintendents having charge of highways, sewers, public buildings and supplies, and of a department of buildings, such appointees act only in his name and can be removed at pleasure, thus enabling him to keep absolute control of the work. He will also be a member of the Board of Estimate and Apportionment, and a member of the Board of Aldermen, with a vote. The number of local improvement districts is increased to twenty-five, and instead of being designated by numbers, old local names are revived to describe them. The Board of Public Improvements is abolished and much of its functions devolve upon the Board of Estimate and Apportionment. This board is to consist of the Mayor, Comptroller, President of the Board of Aldermen and the five Borough Presidents, all of whom are elected by the people, the three first named, elected by the city at large, have three votes each, the presidents of the boroughs of Manhattan and Brooklyn two votes each, and the presidents of the smaller boroughs one vote each, a total of sixteen votes, of which the three officers representing the whole city have a majority. The Departments of Water Supply, Bridges, Street Cleaning, Parks, Police and Fire remain highly centralized as before. It is confidently expected that the changes outlined above will be of great benefit to the different boroughs.

The revised charter deals with the question of the authorizing of bond issues by the Board of Aldermen in a radical and effective manner. Much delay and no little scandal has been caused by the failure of the Municipal Assembly to authorize bond issues, such authorization requiring the affirmative vote of three-fourths of the members elected to each house. The revised charter provides that when a bond issue shall have been authorized by the Board of Estimate and Apportionment a copy of such resolution shall be sent to the Board of Aldermen, which board shall appoint a day not less than one nor more than two weeks later for its consideration. They may adjourn such consideration from time to time, but must take a final vote within six weeks of the receipt of the resolution. If a majority of all the members shall vote against it, the bond issue shall be rejected, but if a majority shall not vote against it within the six weeks allowed, the bond issue shall be considered approved. This gives no opportunity for a member to kill a bond issue without going on record by the simple expedient of absenting himself from meetings.

A new charter for cities of the second class in the state of New York also went into effect on Jan. 1, 1900. This applies to Rochester, Syracuse, Albany and Troy. One of the most noticeable things about this charter is the importance accorded to the office of city engineer. He is appointed by the mayor to hold office during the latter's term. He is a member of the Board of Estimate and Apportionment, together with the Mayor, Comptroller, Corporation Counsel and President of the Common Council.

He is also a member of the board of contract and supply, which board is identical with the board of estimate and apportionment, except that in it the Commissioner of Public Works displaces the president of the Common Council. This board receives all bids and lets all contracts at stated meetings held by it. The City Engineer may appoint his own subordinates who shall serve during his pleasure. What appears to be an excellent and time-saving provision of this new charter is Section 149: "Whenever the Common Council shall direct the opening and laying out of a new street or the alteration of any existing street, or whenever any real estate or interest therein shall be required for any municipal purpose whatever, the Commissioner of Public Works may acquire for

the city the necessary land and real estate by gift or by purchase at a price approved by the Board of Estimate and Apportionment, etc." This might frequently save



E. A. FISHER, PRESIDENT.

valuable time when time is an important consideration.

One of the most remarkable statutes giving arbitrary power to a city officer is to be found in the laws of Massachusetts affecting the City of Boston, and known as Chapter 494 of the laws of 1893. This act provides that after any ordinance shall have been passed providing for the laying out, altering or constructing a highway, or for building a sidewalk or sewer, "the Superintendent of Streets, or any other officer of said city who may be so directed by the mayor of said city, shall have the direction of the work" * * * "and in doing such work may make the grades and coverings of the highway, the heights, widths and materials for the sidewalks, and the other particulars of the construction of the highway, and the locations, sizes and materials of the sewers and pipes to be placed therein, different from those which may be specified in the order therefor, and any work done by said superintendent * * * shall be deemed to be done in carrying out the order therefor, whether done according to the directions in the order or otherwise." A remarkable feature of this provision is that it is made applicable to any ordinance adopted before the act was passed. This law has been upon the statute books for eight years, and the fact that it is still there is pretty good evidence that the arbitrary power thus given has not been abused. In fact no instance of its exercise could be learned except in trifling details.

A legal decision which is likely to be far-reaching in its effect is that of the Master in Chancery on the Peoria electrolysis case, under which the electric railway company is held responsible for damage caused by the action of its return current to mains and pipes of the Peoria Water Company, and which was filed in the United States circuit court for the Northern district of Illinois on May 26 of the present year. If this decision is upheld it will make the electric railway companies peculiarly responsible for damage to gas and water mains and other sub-surface structures and indirectly responsible for damage caused by the escape of water, gas, etc., not the least of which will be damage to asphalt pavements by escaping gas, where this may be caused by leakage from pipes destroyed by electrolysis.

This review has been very superficial. There are many other occurrences well worthy of comment—more worthy possibly than those to which your committee has

C. H. RUST, VICE-PRESIDENT.

confined its observations, but they cannot be touched upon in a report which is made sufficiently brief to justify the hope that it will be listened to or read.

Eleven new members were elected, and the constitution was amended to make 20 members a quorum for the transaction of business. The officers elected are:

E. A. Fisher, city engineer, Rochester, N. Y., president; C. H. Rust, city engineer,

G. W. TILLSON, SECRETARY.

Toronto, Ont., 1st vice-president; G. M. Ballard, chairman of water commission, Newark, N. J., 2d vice-president; Charles C. Brown, consulting engineer, Indianapolis, Ind., 3d vice-president; George W. Tillson, assistant engineer bureau of highways, Brooklyn, N. Y., secretary; F. J. O'Brien, street commissioner, Oswego, N. Y., treasurer; W. B. Howe, city engineer, Concord, N. H., Burton J. Ashley, city engineer Zion City, Chicago, Ill., E. D. Very, city engineer, Niagara Falls, N. Y., finance committee.

Rochester, N. Y., was selected as the next place of meeting.

The retirement of Mr. D. L. Fulton from the secretaryship was much regretted and resolutions of appreciation of his efforts for the society were adopted. After the usual resolutions of thanks for courtesies extended the convention adjourned Wednesday noon to visit the engineering features of the city.

The following persons were registered.

ALLEGHENY, PA.—D. L. Fulton, Superintendent of Highways and Sewers; David Hunter, Jr., Superintendent of Light Plant; G. C. Langenhein, City Engineer.

ATCHISON, KAN.—Fred Giddings, City Engineer.

BOSTON, MASS.—E. T. Sands, Secretary to Street Superintendent; Fred J. Warren, of Warren Brothers Company; B. T. Wheeler, Superintendent of Streets.

BRIDGEPORT, CONN.—Charles E. Williams, Director of Public Works.

BROOKLYN, N. Y.—N. P. Lewis, Chief Engineer Department of Highways; G. W. Tillson, Assistant Engineer Department of Highways.

BUFFALO, N. Y.—C. V. Bardol, City Engineer.

BURLINGTON, IOWA—Emmet Steece, City Engineer.

CALGARY, ALTA.—Charles McMillan, City Clerk.

CHICAGO, ILL.—B. J. Ashley, City Engineer Zion City.

CLEVELAND, OHIO—Arthur Bradley, Director of Public Works.

CONCORD, N. H.—W. B. Howe, City Engineer.

EASTON, PA.—A. Prescott Folwell, Professor of Civil Engineering.

INDIANAPOLIS, IND.—Charles Carroll Brown, Consulting Engineer, Editor MUNICIPAL ENGINEERING.

MADISON, WIS.—F. E. Turneaure, City Engineer.

MILWAUKEE, WIS.—G. H. Benzenberg, Consulting Engineer.

F. J. O'BRIEN, TREASURER.

MINNEAPOLIS, MINN.—F. W. Cappelen, Consulting Engineer.

MONTCLAIR, N. J.—M. O. Leighton, Health Inspector.

MONTREAL, QUE.—Alcide Chaussèe, Building Inspector.

NASHVILLE, TENN.—W. M. Leftwich, City Engineer.

NEWARK, N. J.—Ernest Adam, City Engineer; George M. Ballard, Chairman Water Commission; C. V. Bauman, Street Committee; W. C. Garrison, Water Commissioner; William E. Greathead, Clerk Board of Public Works; M. R. Sherrerd, Superintendent of Water-Works; J. B. Stobaeus, Member Board of Trade; Harrison Van Duyne; J. S. Vinson.

NEW YORK, N. Y.—M. N. Baker, Associate Editor Engineering News; J. W. Howard, Consulting Engineer, Engineering Editor Municipal Journal; F. A. Kummer, Consulting Engineer; Alexander Reed, Consulting Engineer.

NIAGARA FALLS, N. Y.—E. D. Very, City Engineer.

NORTH ADAMS, MASS.—J. H. Emigh, City Engineer.

OSWEGO, N. Y.—F. J. O'Brien, Street Commissioner.

ROCHESTER, N. Y.—E. A. Fisher, City Engineer; G. A. Hotchkin, Engineer of Water-Works.

ST. LOUIS, MO.—R. E. McMath, Consulting Engineer.

ST. PAUL, MINN.—O. Claussen, City Engineer.

SCHENECTADY, N. Y.—O. H. Landreth, Consulting Engineer, State Board of Health.

SHEBOYGAN, WIS.—C. W. Boley, City Engineer.

TORONTO, ONT.—John Jones, Superintendent of Streets; John F. London; C. H. Rust, City Engineer; Bernard Saunders, Alderman.

URBANA, ILL.—A. N. Talbot, Professor of Municipal Engineering.

WILLIAMSPORT, PA.—George D. Snyder, City Engineer.

WILMINGTON, DEL.—Theo. A. Leisen, Superintendent of Parks.

PUBLIC WORK IN BOSTON.

The annual report of Mr. B. T. Wheeler, the superintendent of streets of the city of Boston, Mass., contains much that will be of interest to officials in other municipalities. Macadam seems to be the favorite material for street surfaces, three-fifths of the total street mileage (492 miles) being improved with it. About one-sixth the mileage is improved with gravel and the same amount with granite block, with about 15 miles of asphalt, 0.8 mile of brick and 0.06 mile of wooden block. The use of asphalt on residence streets is not common, although macadam is not entirely satisfactory on those streets having more than the average amount of travel. In the list of asphalt streets are included two short streets of Ayer's coal tar, two of tar concrete and one of asphaltina. The records of cost of repair are carefully kept, and a statement of the averages will be of interest even without a statement of the total traffic. The table on page 324 gives the cost of such repairs for the year 1900.

The price paid for entire replacing of all three classes of pavement was $2.50 a square yard and for surfacing patches was $2 a square yard. Columbus avenue, which was part surface heater work and included over 1,000 square yards of resurfacing, costing 17.6 cents a square yard, is not included in the table. Patching made necessary by settlement, resetting of edgestones, crosswalks and other reconstructions not properly chargeable to asphalt repairs is not included in the tables. There seems to be no progressive increase in the cost of repairs with increase in age of pavement. There is an increased demand for asphalt pavements, particularly in residence districts. A small amount of wooden block pavement has been laid for experimental purposes. This pavement is described in an article by Mr. Wheeler on another page. All asphalt and wooden block streets are now laid with a ten-year guaranty.

The large amount of material required for macadam streets is furnished by the city, which owns several rock crushing plants. A new one with a capacity of 300 tons a day was constructed on Iffley road in 1900. Its excellent design and construction can be seen from the picture accompanying.

Some idea of the great improvements made in some streets during the year can be gained by comparing the view of Commonwealth avenue, north of Wallingford road, on page 391, December, 1900, with the view of the same locality shown on one of the accompanying illustrations. The upper and lower roadways and the separation of electric railway from them are clearly shown.

The district is now ready for improvement of the property adjoining the road.

The sanitary division of the department has charge of the removal of garbage and waste. For the last two years this matter has been separated into three parts, house dirt and ashes, of which 344,682 loads of 44 cubic feet each were removed in 1900; waste and rubbish, of which the ash carts removed 1,514 loads, the paper carts 11,452 loads and the market wagons 5,494 loads, a total of 18,460 loads; and house offal, of which 62,975 loads of 56 cubic feet or 1½ tons were removed in 1900. Most of the city is served by the city's own teams and laborers, but three or four suburban districts being served by contractors. Ashes of manufacturing plants and street refuse are not included in these statements.

COST OF PATCHING ASPHALT PAVEMENTS IN BOSTON FOR 1900.

1. Trinidad Asphalt.

Year pavement was laid.	Area. sq. yds.	Cost of patching.	Av. cost per sq. yd.
1881	2,079	$47 39	$0.023
1883	920	128 40	.140
1884	2,700	315 09	.117
1887	4,883	280 43	.057
1888	1,665	144 92	.087
1889	1,142	307 43	.269
1891	16,502	1,284 67	.078
1892	26,113	2,153 20	.082
1893	7,422	862 88	.116
1894	5,609	336 17	.060
Totals	69,035	$5,860 58	$0.085

2. Sicilian Rock Asphalt.

1892	3,483	$370 13	$0.106
1893	2,723	71 02	.026
1894	6,937	175 08	.025
Totals	13,143	$616 23	$0.047

3. Coal Tar on Cobble Base.

....	1,452	$292 67	$0.202

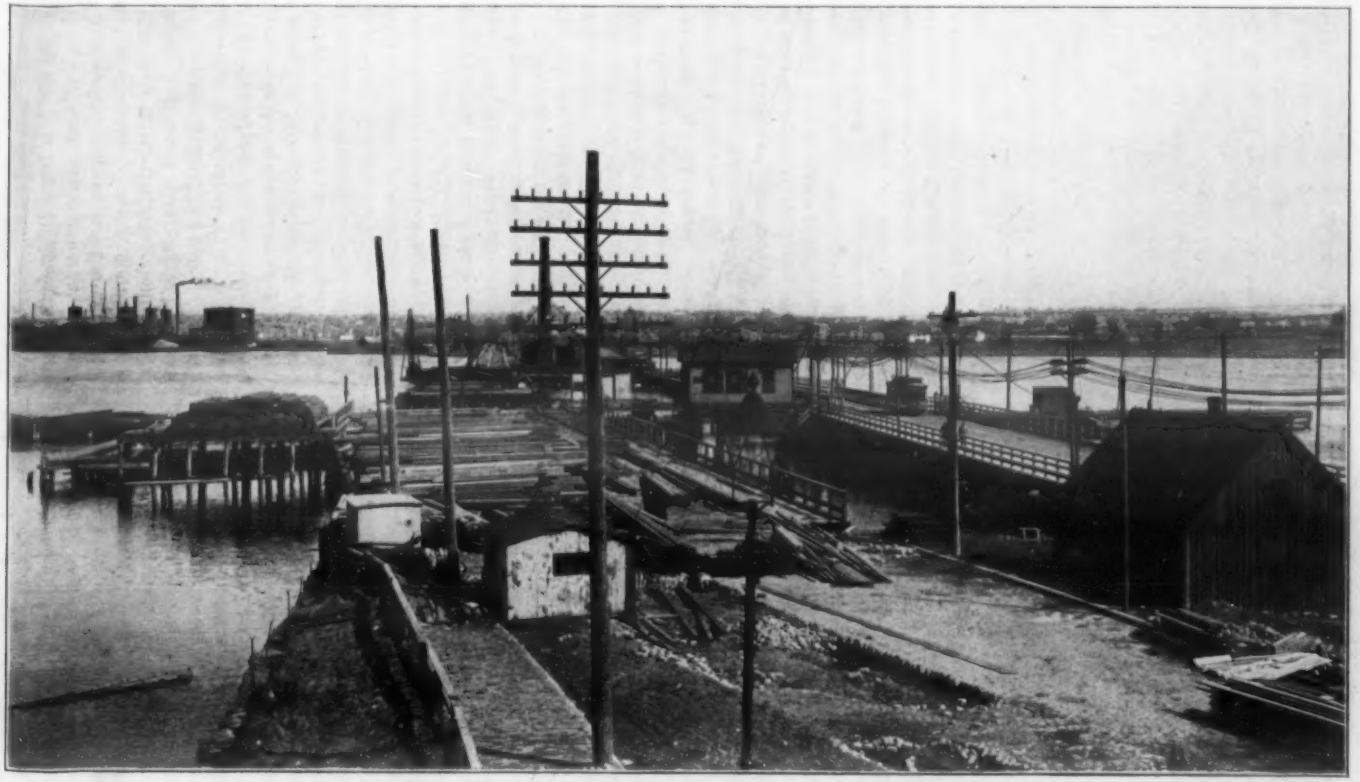
The sewer division has an appropriation of $1,000,000 a year for new construction, and with appropriations for maintenance and for the Stony Brook improvement expended nearly $1,500,000 in 1900. This has been largely upon important works of large size. Our illustrations show the construction of a new brick sewer within an old stone sewer under what was formerly Blake street, to strengthen it for the heavy railroad traffic now passing over it, and the Stony Brook improvement at the entrance of the Boylston avenue supplementary channels. Another illustration shows the Adams street culvert over Davenport brook in Dorchester.

In building the Goldsmith brook conduit in St. Joseph street, in West Roxbury, a bed of quicksand 60 feet deep was encountered, the level of the ground water being near the top of the proposed 6-foot sewer. There being no coarser stratum below from which the water could be pumped through ordinary wells, a special expedient was tried. A number of 10-inch pipes were sunk by means of water jets to points 20 to 25 feet below the grade of the sewer. Inside these pipes were inserted 2½-inch pipes with perforations for about 5 feet from the bottom. The remaining space in the 10-inch pipe was then filled with coarse sand and the large pipe was withdrawn. The well was thus surrounded by coarse material through which the water could flow to the well tube. The water was raised by a steam ejector pump at the bottom of the well, connected with a small pipe inside the 2½-inch well tube. By this method the ground water was lowered enough to permit the construction of the sewer. The accompanying sketch shows the details of the design for the wells and the method of discharging the water.

Municipal officials who find it difficult to secure needful appropriations for work may find the method of showing the needs of the department used in this report to be effective. While the appropriations for new construction seem to be ample, the appropriations for maintenance have not kept pace with the increasing needs of the department on account of the rapid increase in length of sewers to be taken care of. The accompanying diagram, reproduced from the report, shows graphically in most convincing manner the rate of increase of the discrepancy between the needs of the department and its resources.

The department of street cleaning has returned to the system of machine sweeping of paved streets at night, and broom patrol by day, with improvement in the condition of streets. The inability of the police department to prevent the sweeping of house and store litter into the streets is complained of, and a paper patrol system has been organized to reduce the resulting nuisance. The result is satisfactory and the continuance of the patrol is proposed, the benefits being commensurate with the extra cost, so long as the ordinances mentioned are not enforced.

The bridge department has had no new work to do except the beginning of the construction of the new Malden bridge. The accompanying illustration shows the progress of the work and the temporary bridge in use.



MALDEN BRIDGE, SHOWING TEMPORARY BRIDGE ON RIGHT, BOSTON, MASS.

EDITORIAL COMMENT.

Co-operation of Municipal Societies.

Several times within the past two or three years a closer affiliation of the numerous societies devoted to the discussion of problems of municipal life has been suggested. The proposition has met with some favor, but some of the societies have held themselves aloof, feeling that too close a combination might interfere with their freedom, while others have not been interested, because they have not recognized the value of societies other than their own. The American Society of Municipal Improvements has taken more definite steps than any other, but, as stated in President McMath's address in the report of the Niagara Falls convention, its overtures to the National Municipal League met with no response. Mr. McMath, himself, suggests simply that the societies agree upon the same time to meet in St. Louis in 1903, at the exposition celebrating the centennial of the Louisiana purchase. The A. S. M. I. did not take any steps toward carrying out this proposition by suggesting a time for the consideration of the other societies and providing for the correspondence necessary to put the matter prominently before the next conventions of the societies likely to be interested. The new secretary of the society may take up the matter without formal society action, however. The week of October 5, 1903, is suggested as the common date of all the meetings, as it is not far from the usual dates of most of them; and the weather, and especially the temperature conditions, are most favorable in St. Louis at that time. In addition to the two societies mentioned, the League of American Municipalities and the new National Association of Improvement Clubs, the national organization of Village Improvement societies, and the Civic Alliance should be interested. Some of the State Municipal Leagues may find it advantageous to hold their conventions at St. Louis in this week also, as well as other societies less closely allied to those mentioned.

Undoubtedly a combination of all these societies into one close organization would be disastrous to the work of nearly all, but many benefits may be derived from selection of the same time and place of meeting, aside from those of reduced railroad rates and opportunity for personal contact of the members of the various societies. A loose organization similar to that of the American Association for the Advancement of Science, or the National Educational Association, permits each society to retain its individuality of purpose and to concentrate itself upon its own work and at the same time extends the usefulness of each society by making it possible for many members of other societies to attend such sessions as are of special interest to them, without neglecting the work of their own associations. A central board of managers, selected representatives of each of the affiliated societies, can be empowered to arrange details of times and places of meeting and to take charge of the carrying out of these details and of the publication of the proceedings of the societies as reported to them by the various secretaries. The officers of the societies are thus relieved of much of the drudgery preliminary to the meetings and can spend their time in strengthening the programs of their sessions.

While it is not probable that this affiliation would result in as large conventions as those of the A. A. A. S. and the N. E. A., it would undoubtedly increase the aggregate attendance very largely and thus increase the usefulness of all.

A common choice of the time and place suggested will give opportunity for a joint meeting of all the societies at which a plan for affiliation can be presented and discussed, thus settling the question of the advisability of the proposed step and setting the machinery promptly in motion.

What Can the City Do?

A correspondent states a difficulty with the water supply system in his city which is not uncommon, though perhaps it is more than usually aggravated in his case. It seems that the city has added to its water supply as the needs increased without proper engineering advice and foresight, and has now reached the limit of the present supply, and has also reached the limit of its municipal indebtedness. The question is, what can be done? One phase of the question may well be discussed here.

Such extremity as this is the opportunity of the water-works promoter. He is accustomed to play upon the ignorance of the municipal officials, to fill them with additional fears for the present situation, and to demonstrate by skillfully manipulated figures the worthlessness of the present plant, finally inducing them to turn over the plant for a nominal sum under a most favorable contract for the future supply of water to the city and to private consumers. A little cash judiciously placed sometimes aids wonderfully in bringing about the final agreement.

The only safety for the city in such case is in competent engineering and legal ad-

vice by persons without bias or suspicion of susceptibility to undue influences. Perhaps a thorough expert examination of the case would show the possibility of a sufficient increase in the city's supply without passing beyond the debt limit. Perhaps the debt limit can be raised by proper effort. But whether these things can be accomplished or not, the full investigation of the legal and engineering questions involved will place the city in position to know what can be done, what the new supply can be procured for, what the old system is worth, in short, to make a contract for the new supply which shall be equitable to the company and shall protect the city and the individual consumers from the high rates which are so often fixed under similar circumstances.

Such restriction of the terms of the contract may drive off the class of contractors mentioned, but will leave the field for those who are satisfied with reasonable profit or for public spirited citizens who will make it possible for the city to again own its plant when changes in circumstances make it desirable.

A few hundred dollars expended in this investigation will save many times the amount in the capital account and in annual payments for service rendered or interest upon money invested.

There are so many similar cases in which the tendency is to save the cost of expert advice without knowing that it is at the expense of future payments for errors that could have been avoided, that this sort of statement is always in order.

The State Municipal Leagues.

An interesting development of recent years among city officials is that of the State Municipal Leagues which have been formed in several states. They show the increasing interest of municipal officials in their work, and the desire among the more progressive cities, of more and better information to help solve the problems of municipal government. Two or three of these movements have been so strong that they have been able to support, at least in part, monthly or quarterly periodicals devoted to their interests, and nearly all show continuing interest in meetings, notwithstanding the frequent changes in personnel.

These leagues have the same troubles to contend with in rotation of members out of office that the national societies have.

Attorneys acting as mayors, as city attorneys, or as councilmen seem to have the most permanence as members of the organization, and its destiny is very largely in their hands. With a few such competent persons with reasonably permanent tenure of office, a vigorous society capable of great good is developed. New memberships must be worked up each year in both old and new cities to make up the losses from expiration of terms of office, so that the interest in the society is likely to be rather fitful, but it is certainly an encouraging sign of the times that under all the discouragements which are so evident, the interest continues to have so lively an expression. As an example of what can be done in the preparation and the carrying out of a program by a few earnest workers, reference is made to the report of the recent meeting of the Indiana Municipal League to be found on another page of this number. While it is not probable that the same effort will be put upon every program, the material success of one is the proof that all can be made of the highest value and is encouragement to those most interested to continue the good work even when the discouragements are almost overwhelming.

Reference is made to the report mentioned for information as to what a representative program can be. The list of subjects and papers as originally announced contained a representation of every branch of the city government. The representatives of the councilmen and of the city engineers failed to do their assigned share, though the councilmen were prominent in discussions and the engineers were not altogether silent.

The movement is worthy of all encouragement and if persistently followed up will undoubtedly result in great good to the communities as it has already to their representatives at the conventions.

The Technolexicon.

Dr. Hubert Jansen, the editor of the proposed Technolexicon, to be published by the Society of German Engineers, desires to lay stronger emphasis upon one or two points mentioned in the notice of the work in this department in the September number. First, as to the cost of the work. This will apparently be very large, but the Society of German Engineers will publish the work and expects to expend a large amount of money in making it as complete as possible, and at the same time as cheap as possible. The price of the dictionary will be set without particular reference to the cost of making it, the reimbursement of the society by the sale of copies being quite of secondary importance. Second, full instructions for furnishing information for the work are supplied

in special descriptive circulars, which will be sent, with notebooks in which to enter the information, on application to Dr. Hubert Jansen, Dorotheenstrasse 49, Berlin (N. W. 7), Germany. Full descriptions of terms used, district in which the term is used with the meaning given, equivalents in German or French, are all desired. Out of the mass of material thus collected, standard definitions can be devised and full notes of sectional variations in meanings can be added.

The work is of much importance to all engineers, and every one interested in any branch of engineering or contracting is requested to add his contribution, large or small, to the completeness of the book.

THE QUESTION DEPARTMENT.

MOLDS FOR CEMENT BUILDING BLOCKS.

Will you advise us where to find forms or machines for making cement building blocks? Are there any patents on the process, or machines for making them?

Terry & Lewis, Galesburg, Ill.

The general process of making cement building blocks is not patentable. Solid blocks of small and of large size have long been made in forms built up of wood and removable in sections, or in small forms of wood or metal, from which blocks can be removed when set. These forms can be made of any desired design or pattern by carpenter or iron founder. If hollow blocks are desired, proper spacing blocks, usually of wood, can be used. Doubtless, the firms listed in our Business Directory, in the first sixteen pages, under the headings of "Cement Tools," or "Contractor's Tools," will supply, or make to order, any forms desired. There are several patents on particular mixtures of materials and on special forms or patterns, which are in successful use. See the list of Recent Inventions in the department of "Machinery and Trade" for notice of new issues of patent in these lines.

LINING FOR RESERVOIR.

Would concrete make a good lining for a reservoir in excavation on a site composed largely of sand and gravel? The dimensions would be 30 feet by 230 feet and 7 feet deep. What would be the thickness of walls and what the proportions of cement and gravel? I understand that most of the forms used for foundation walls are held together with iron bolts which are removed after concrete has become hard, and openings filled with cement mortar. Must this plan be followed in case of the reservoir?

Dow R. Gwinn, Pres. Water-Works Co., Terre Haute, Ind.

Concrete would make a good lining for a reservoir such as is described, if proper precautions are taken to prevent cracking of the concrete, and it is made water-tight. Reference is made to answers to questions in this department on page 23, July, 1901, entitled "Thickness of Reservoir Wall," and "Construction of a Small Reservoir," also on page 232, October, 1901, "How to Dig a Well in Sand."

If the bottom and slopes or walls of the reservoir are not open to the heat of the sun there will be little or no cracking of the concrete if it is laid in a continuous sheet. If there are great variations in temperature, the concrete should be laid in blocks, with expansion joints. In Pittsburg the blocks were made 9 inches thick and 7 feet square, and the joints were $\frac{3}{8}$ inch wide at bottom and $\frac{3}{4}$ inch at the top and filled with asphalt. A half-inch of Portland cement mortar was put on as a top coat. At Albany the blocks are 7 feet square and asphalt joints are $\frac{1}{2}$ inch wide and half the depth. Blocks are made in some cases as large as 20 feet square.

There is considerable variation in the proportion of materials. In Pittsburg the concrete was 1 part cement, 2 parts sand and 4 parts broken stone, which would correspond to about 1 part cement to $4\frac{1}{2}$ parts of clean gravel of graded sizes of grains; and the top coat was 1 part Portland cement to 1 part of sand. At Havana, Cuba, two six-inch layers of concrete were used, made of 1 part best Portland cement, 3 parts sand and 5 parts broken stone—equivalent to about 1 part cement and $5\frac{1}{2}$ gravel. At Syracuse the 9-inch layer is made of 1 part natural hydraulic cement, 2 parts sand and 3 parts stone—equivalent to 1 part cement and about $3\frac{1}{2}$ parts gravel. At Haverhill, Mass., the concrete was made of natural hydraulic cement, and had a minimum thickness of 4 inches.

Concrete that is thick enough and well mixed and laid can be made very nearly water-tight, especially if laid in two layers, as at Havana, well plastered with a rich cement mortar. Engineers usually consider it necessary, however, to take some additional precautions when slight leakage is objectionable. At Albany clay puddle made of equal volumes of clay and mixed sand

and gravel was deposited in three layers, on which the concrete was then laid. At Astoria, Ore., the bottom was covered with 6 inches of concrete containing 0.9 cu. yd. of crushed rock, 0.5 cu. yd. of gravel, 0.1 cu. yd. of sand and 1 barrel of Portland cement per cu. yd., cut in blocks of 20 ft. square, with ½ inch asphalt joints, and this was covered with a ⅜-inch cement mortar finish and two coats of asphalt, one soft and the other harder, and together a little more than one inch thick. This bottom cost complete about 13 cents a square foot. The slopes had 6 inches concrete, ⅔ inch asphalt, a layer of brick and a second coat of asphalt 0.85 inch thick and cost nearly 24 cents a square foot. The most common practice is probably from 18 to 24 inches of clay puddle under concrete or paving.

Forms are not necessary for placing concrete on bottom or on slopes. At Albany an 8-inch vertical brick wall was used for the face of the reservoir wall and the concrete was put in back of this wall after it was completed, so that a form was necessary only for one side. The tying together of forms by rods through the wall is only a matter of convenience, and the forms can be braced up strong enough without their use. They are not advisable in a reservoir wall, though the holes left when removing them can undoubtedly be filled so as to prevent leakage, if necessary.

CONCRETE FOR WALLS AND BALUSTRADES.

I would like some information on making concrete walls, especially for low fences suitable for cemetery lots.

J. W. Colyer,
Council Grove, Kan.

In addition to the information given in the "Directory of American Cement Industries and Hand-Book for Cement Users," reference may be made to some recent articles in MUNICIPAL ENGINEERING as follows: "Melan Arch Bridges in Indianapolis," page 63, February, 1901; "Cement for Steps," page 151, March, 1901; "Coloring Cement," page 302, May, 1901; "Wooden Forms for Concrete Work," page 360, June, 1901; "Concrete Construction, Mixtures and Manner of Placing in Forms," page 112, August, 1901; "Concrete for Buildings," page 214, October, 1901.

As in the case of stone or brick walls care must be taken to put in sufficient foundations of sufficient depth to withstand the action of frost. These foundations are best made of Portland cement concrete, using some large-sized stones, if desired, and the portion of the wall above the surface should be constructed as an integral part of the foundation. Design the surfaces of wall and foundation to shed water from wall and foundation, and drain the water away over the surface or by subsoil drain. Any desired finish can be given to exposed surfaces before final set has taken place and ornamental figures can be constructed as a part of the work, or made in separate molds and attached as ordinary stone work would be.

BOOKS ON ORNAMENTAL CONCRETING.

Can you give me the names of any books on ornamental concreting?

J. S. Irwin, Kingman, Ala.

There are no American books treating of this subject exclusively. Hodgson's "Plaster and Plastering, Mortars and Cements," ($1), gives numerous figures of ornamental work in plaster and cement for ceilings, cornices, arches, etc., and some instruction in applying them. The application of cement mortar to such purposes is usually so simple that the study of the principles of design is all that is necessary to add to practice in handling the material in order to do satisfactory work. An expert in the use of plaster for ornamentation of surfaces and in casts can soon become equally expert in the use of cement for these purposes. There are some German works upon the subject, the names of which can be procured if desired.

CEMENT PLANTS AND MANUFACTURE.

I would like to get some published information on the manufacture of cement, including the construction of plant, quarrying the rock, handling, etc.

J. W. Walker, Pittsburg, Pa.

There are some valuable French works on the details of cement manufacture, including design of buildings and machinery. They do not include the recent developments in cement machinery which have been made in this country. In fact this development has been so rapid that no books have been able to keep up with it. Beginning at the quarry, treatises on rock blasting and on explosive compounds can be obtained, such as Drinker's "Treatise on Explosive Compounds, Machine Rock Drills and Blasting" ($5). Buildings can be constructed of wood, brick, iron or concrete, and there are many books upon all these except the last. Articles now appearing in MUNICIPAL ENGINEERING MAGAZINE give much assistance in the study of concrete for buildings. The article appearing in the October number has an illustration of a concrete building for a cement factory in process of construction.

The "Directory of American Cement Industries and Hand-Book for Cement Users"

(85) gives descriptions of many of the cement plants of the United States and Europe, and is thus of great value in developing a design for a new plant. It is the only book which gives a full view of the cement field, and has more material which will be of assistance in the lines of the question than any other book published.

The trade circulars of the manufacturers of conveying machinery, grinding machinery, quarry tools and machinery, etc., contain much valuable practical information upon the details of the various implements, machines and processes.

NATURAL AND ARTIFICIAL MIXTURES FOR ASPHALT PAVEMENTS.

Can you advise me as to the relative values for streets of rock asphalt, such as is mined in Kentucky, and lake asphalt?

H. Rorra, Evansville, Ind.

The answer to this question requires a comparison of the merits of what may be called natural mixtures, obtained in the form of asphalt rock from quarries, and artificial mixtures made by adding stone in some form to asphalt refined to a greater or less degree of purity.

The earliest asphalt pavements were laid in Europe, using asphalt rock taken from mines, and this kind of asphalt is still in use in England, France, and other European countries almost to the exclusion of any other such material. The rock is an asphaltic limestone, some deposits of which are almost perfect mixtures for paving purposes. Many improvements in preparation of the material for use have been developed.

In this country there are several deposits of asphalt rock, most of which are asphaltic sandstone, there being but few deposits of asphaltic limestone. These materials must receive different treatment from those found in Europe. Successful pavements have been laid with mixtures of Kentucky asphaltic sandstone and foreign asphaltic limestone, with mixtures of asphaltic limestone and sandstone from different deposits in Indian Territory, with California and other asphalt rock deposits.

The first successful asphalt pavements made with artificial mixtures were laid nearly thirty years ago, using Trinidad asphalt, which is an intimate mixture of asphalt and finely divided silicious and calcareous matter. Successful pavements are now laid with purer asphalts found in Venezuela, California, Utah and elsewhere.

The steps toward a good pavement are the selection of proper materials and their proper combination. Expert knowledge of the materials is therefore demanded, and sufficient trial of the pavement mixtures to prove their adaptability to the conditions to which the pavement is to be subjected.

The foreign asphalt rock and the artificial pavement mixtures using Trinidad, Venezuelan and several American asphalts have been used long enough and under varied conditions enough to show their adaptability to almost any locality. The American asphalt rocks have been used less generally, but the success of expert contractors with them has been such that their adaptability to all conditions is only a question of careful expert study and experience.

In addition to these reasons for not placing the future performance of one of the asphaltic materials now in use above that of another is the question of expertness of contractor. What may seem to be an inferior material may, in the hands of an experienced contractor, produce a much more satisfactory result than a presumably better material laid by a man who has not had experience with it.

Artificial asphalt pavements are made up almost entirely of materials obtained in the immediate neighborhood, the proportion of asphalt upon which freight is to be paid being comparatively small. Freight must be paid upon the whole of the wearing surface of a pavement made of asphalt rock. It is evident, therefore, that the asphalt for the artificial pavement can be brought for long distances and compete in price with the natural rock pavements, with the exception of an area about the asphalt deposit, whose size depends on the interest of the railroads in the development of the industry as shown in the fixing of freight rates, within which, cities may find themselves able to get good asphalt pavements at lower prices than are paid by those less fortunately located.

COST OF SEWER SYSTEMS IN CITIES OF 20,000 POPULATION.

We note on page 155 of the September number a query on the comparative cost of sewer systems for cities of 100,000 population, which interests us greatly. We would like to have you give a similar statement of the comparative cost in cities of 20,000 population.

Forrest & Co,
Philadelphia, Pa.

The following data regarding cost of sewer systems in cities approximating 20,000 population are taken from "Social Statistics of Cities" of the eleventh census for 1890. Satisfactory data on cost of sewers for 1900 are not now at hand.

COST OF SEWER SYSTEMS IN CITIES. POPULATION ABOUT TWENTY THOUSAND.

1. Having Sanitary Sewers.

CITY.	Population.		Length in Mls. of Sts. and Alleys.		Length in Miles of Sewers.		Cost of Sewers in 1890.		Population per Mile of Sewer, 1890.
	1890.	1900.	1890.	1900.	1890.	1900.	Total.	Per Capita.	
Akron, Ohio*	27,601	42,728	85	151	10	51	$208,000	7.54	2,760
Amsterdam, N. Y.*	17,336	20,929	....	....	22	....	218,505	12.60	788
Atlantic City, N. J	13,055	27,838	30	....	22	....	225,000	17.24	593
Colorado Springs, Colo	11,140	21,085	95	....	10	....	50,000	3.56	1,114
Davenport, Iowa*	26,872	35,254	140	120	6	33	75,375	2.80	4,479
Decatur, Ill.*	16,841	20,754	....	....	5	....	30,000	1.78	3,368
Fort Worth, Texas*	23,076	26,688	73	....	25	....	150,000	6.50	923
Kalamazoo, Mich	17,853	24,404	80	....	14	....	75,639	4.24	1,275
Montgomery, Ala.*	21,883	30,346	33	43	17	59	123,345	5.64	1,287
Muskegon, Mich.*	22,702	20,818	250	....	4	....	14,000	0.62	5,676
Schenectady, N. Y	19,902	31,682	50	59	16	38	55,000	2.76	1,244
Waco, Texas*	14,445	20,686	80	....	7	....	35,000	2.42	2,064

* These cities have short storm water sewers in addition to the systems of sanitary sewers.

2. Having Combined Systems of Sewers.

Anderson, Ind.†	10,741	20,178	127	.....	1	.....	1,600	0.15	10,741
Auburn, N. Y	25,858	30,345	80	80	35	70	500,000	19.33	739
Birmingham, Ala	26,178	38,415	81	166	21	56	212,800	8.13	1,247
Bloomington, Ill.	20,484	23,286	90	.....	15	.....	200,000	9.77	1,366
Burlington, Iowa	22,565	23,201	120	.....	4	.....	155,253	6.88	5,641
Canton, Ohio†	26,189	30,667	50	59	29	30	80,000	3.05	903
Cedar Rapids, Iowa	18,020	25,656	200	.....	12	.....	150,000	8.32	1,502
Chelsea, Mass.	27,909	34,072	53	.....	31	32	443,471	15.89	900
Clinton, Iowa†	13,619	22,698	19	.....	4	.....	24,000	1.76	3,405
Cohoes, N. Y.	22,509	23,910	30	.....	6	.....	141,160	6.27	3,752
Council Bluffs, Iowa	21,474	25,802	250	.....	21	.....	136,000	6.33	1,023
East St. Louis, Ill.†	15,169	29,655	43		10	.....	50,000	3.30	1,517
Fitchburg, Mass	22,037	31,531	118	128	13	30	133,853	6.08	1,695
Haverhill, Mass	27,412	37,175	101	146	17	36	190,000	6.93	1,612
Jacksonville, Fla	17,201	28,429	127	.....	8	.....	68,000	3.95	2,150
Kingston, N. Y.†	21,261	24,535	54	.....	11	.....	50,879	2.39	1,933
La Crosse, Wis.	25,090	28,895	125	.....	4	.....	75,000	2.99	6,273
Leavenworth, Kan.	19,768	20,735	224	.....	10	.....	103,971	5.25	1,977
Lewiston, Me.	21,701	23,761	110	.....	16	.....	225,000	10.37	1,356
Lima, Ohio.	15,981	21,723	66	.....	14	.....	81,350	5.09	1,142
Little Rock, Ark.	25,874	38,307	125	238	15	17	80,000	3.09	1,725
McKeesport, Pa	20,741	34,227	50	119	12	24	350,000	16.87	1,728
New Britain, Conn	16,519	25,998	39	.....	15	.....	161,000	9.75	1,101
Newburg, N. Y.	23,087	24,943	85	.....	13	.....	250,000	10.83	1,776
Newport, R. I.	19,457	22,034	64	.....	25	.....	291,471	14.98	778
Oshkosh, Wis.	22,836	28,284	54	.....	34	.....	97,000	4.25	672
Oswego, N. Y	21,842	22,199	67	.....	19	.....	80,000	3.66	1,150
Poughkeepsie, N. Y.	22,206	24,029	60	.....	13	.....	450,282	20.27	1,708
Pueblo, Col.	24,538	28,157	425	.....	26	.....	275,000	11.20	945
Racine, Wis.†.	21,014	29,102	69	.....	2	.....	11,200	6.53	10,507
Rockford, Ill.†.	23,584	31,051	120	130	8	25	41,500	1.76	2,948
Sacramento, Cal.	26,386	29,282	140	.....	22	.....	150,000	5.68	1,199
San Jose, Cal.	18,060	21,500	125	.....	38	.....	460,400	25.47	475
Waterbury, Conn.	28,646	45,859	40	48	20	34	326,000	11.38	1,432
Wichita, Kan.	23,853	24,671	437	.....	39	.....	204,247	8.56	612
York, Pa.†.	20,793	33,708	50	66	3	4	5,000	0.24	6,931
Zanesville, Ohio	21,009	23,538	94	.....	7	.....	125,000	5.95	3,001

† These cities had such inadequate systems in 1890, that they are omitted from all consideration and from all averages.

The first part of the table gives the cost of various sewer systems where sanitary sewers form the major part of the system, there being a few hundred feet of storm-water sewers in use in the cities marked with a star. This is the usual condition in cities of this size which have adopted the separate system. The average cost per capita, including all the cities in the table, is $5.41, and is obtained by dividing the total cost in these cities by their total population. It is estimated that those cities which have a population per mile of sewer less than 1,500 to 2,000 are well sewered, while the systems where this population is more than 2,000 are not complete. Selecting the cities with population per mile of sewer less than 2,000, the average cost per capita is $6.47. This would make a system of sanitary sewers, with such short lines of storm-water sewers as are usually necessary, cost about $130,000 for a city of 20,000 people. The mileage of streets must be taken into account in estimating the cost, a thinly settled city requiring more miles of sewer for the same population than one occupying less territory. The expense of special work must also be added. Thus the cost of the sewer system of Amsterdam,

N. Y., is increased over that of Schenectady, N. Y., by the large amount of rock cut necessary in the former place.

The second part of the table gives the cost of sewer systems in cities which have adopted the combined system, discharging both storm-water and sewage through the same sewers. The remarks made above will apply to this section of the table also. The cities marked † are supplied with so small mileage of sewers that it is not fair to include them in averages, and they are therefore dropped from the consideration. The average cost of sewers per capita in all the other cities of the list is $9.20. The average cost in cities having less than 2,000 population per mile of sewer is $10.46, and in those having less than 1,500 is $10.62. This would make a combined system to serve a city of 20,000 cost about $210,000. A close study of the columns of street-length, cost, cost per capita and population per mile of sewer will be well repaid. It should be noted that the mileage given is of streets and alleys and that in eastern cities this approximates the street mileage, while in western cities the alley mileage may be more than one-third of the total mileage.

From the tables of averages in the census volume from which these data are taken it is learned that the 41 cities reporting, having populations between 15,000 and 25,000, had 633 miles of sewers, 1,283 population per mile of sewer and $7.96 average cost per capita, no separation of partial systems being made, and no distinction between separate and combined systems being drawn.

The answer on page 155 of the September number should be read in this connection. The table near the top of the second column, giving population per mile of sewer should be corrected by placing 1890 at the head of the first column and 1900 at the head of the second column.

GARBAGE AND REFUSE WAGONS.

What kind of wagon or conveyance is best suited for use in removing night soil from vaults, emptying cess-pools, and general conveyance of garbage and matter of this character, to the city dumping grounds or crematory?

C. W. Swearingen, City Engineer,
Great Falls, Mont.

The removal of night soil and the transportation of garbage and ordinary city refuse are operations which are quite distinct. The same wagon, if properly designed to be tightly closed and promptly, easily and thoroughly cleaned, may be used for transporting both night soil and other refuse and garbage. Our advertising columns give the names of manufacturers of such wagons. On page 330 of the number for June, 1901, will be found a picture of a wagon which is reported to be satisfactory for the transportation of garbage, and seems to be adapted to use for night soil. It is manufactured by the United States Sanitary Company, of Washington, D. C. Other hints on forms of wagon will be found in articles, a list of which will be found on page 152, September, 1901. There are closed tanks arranged with hose and pump connections for pumping the contents of cess-pools into them, thus preventing nuisance at the point of loading. The wagon mentioned can be provided with packing under lids, splash apron inside screw down holders and pump connections for transfer of material from pool to cart without nuisance.

BOOKS ON SEWERS AND STREETS.

Will you please give me a list of books relating to sewers, grades, street foundations, curbing, etc., with reference to macadam and other road materials.

Edward Wilkeson,
Solvay, N. Y.

See MUNICIPAL ENGINEERING, page 90, August, 1900; page 83, February, 1901; page 150, March, 1901, for full lists and reviews of books on sewerage and paving. Those most suitable to your requirements are probably Folwell's "Sewerage" ($3), Staley & Pierson's "Separate System of Sewerage" ($3), Byrne's "Highway Construction" ($5), and Tillson's "Streets, Pavements and Paving Materials" ($4). An article reviewing the recent books on paving will be given in an early number.

SURVEYS AND NOTES FOR WATER AND SEWER SYSTEMS.

What book or books will describe in a detailed manner the method of procedure and of keeping notes for a preliminary survey for water works and sewerage? Also how best to make a survey of a city or town so as to make a map of the same.

Subscriber,
——, Conn.

There is no book giving complete statement of all details of such work. The chapter on City Surveying in Staley's "Gillespie's Surveying," second volume on Higher Surveying ($2.50), is perhaps the best description of all the works outlined in the question. Johnson's "Theory and Practice of Surveying" ($4) has a good chapter on the field and office work for making city maps. Staley and Pierson's "Separate System of Sewerage" ($3) gives the most detailed statement of methods of staking out work and keeping notes of construction. Folwell's "Sewerage" ($3), and "Water Supply Engineering" ($4), and

Goodell's "Waterworks for Small Cities and Towns" ($2), have many valuable suggestions on methods of making surveys and keeping records.

FOREIGN MUNICIPAL ENGINEERING MAGAZINES.

Could you let me have the address of some valuable periodical magazine on municipal engineering published in France and in England?

Ernest Belanger, Assistant City Surveyor, Montreal, Que.

In England "The Surveyor and Municipal and County Engineer," published at 13 New Street Hill, Fleet Street, London, E. C., and the "Municipal Journal," London, are weeklies devoted to municipal sanitation and engineering. The foreign subscription price is 19s. a year. In France, "Annales des Ponts et Chaussées," "Nouvelles Annales de la Construction," "Le Genie Civil," all published in Paris, devote space to municipal engineering.

BOOKS ON PUMPING MACHINERY.

Please give the titles and prices of good books on pumping machinery. *George C. Blance, Winter Harbor, Me.*

A recent American book on this subject is Barr's "Pumping Machinery" ($5). Turneaure's "Public Water Supplies" ($5) has an excellent chapter on pumping machinery, written by D. W. Mead. Among English books may be mentioned Colyer's "Pumps and Pumping Machinery," first volume, $10, second volume, $2: Bale's "Pumps and Pumping," $1: Bjorling's "Pumps and Pump Motors," 2 volumes, $20. Bjorling also has several smaller books on special branches of the subject. There are books on the theory of such machinery, for example, Weisbach and Hermann's "Mechanics of Pumping Machinery" ($3.75). Municipal Engineering Company can furnish any of these books, postpaid, at the prices given.

BURNT CLAY FOR ROADS.

We have neither rock nor gravel in this district and so have no macadam. The soil is mostly a stiff red clay, which in a rain works up into a very heavy muck which makes hauling extremely difficult. I am trying to get some information concerning the burning of clay to be used as a macadam.

Wilkie Woodard, Shreveport, La.

Railroads in Iowa, such as the Chicago, Burlington and Quincy and the Chicago, Milwaukee and St. Paul, use burnt clay for ballast in considerable quantities. Their process is to make triangular piles of clay of any length desired, arranged to apply wood or coal fires against the material, the action of the fire being to bake the clay sufficiently to make it answer the purpose of ballast. The burnt clay is porous, and any dust formed is soon washed into the inner spaces by the rain. An article on "Burned Clay Ballast" in our department of "Current Information" gives some details of the process and of the action of the burnt clay. Prepared in this way the clay is probably too porous and friable to make satisfactory road material when anything else is available, but it is quite possible that a more thorough method of burning would increase the cost more than it would increase the durability of the resulting material. The clay is cheap, and if it can be prepared from the material now in the road and adjacent thereto it may be possible to procure a fairly satisfactory road at reasonable cost by using a sufficient quantity of the burnt clay. Investigation of the value of cement in combination with burnt clay for the wearing surface is suggested. The trial of oil in the manner adopted for certain roads in California and described on page 28 of MUNICIPAL ENGINEERING for January, 1901, is also suggested. Thorough drainage of roadbed and surface is the first requisite for any of the plans proposed.

BITUMINIZED PAPER WATER PIPES.

Who makes or sells bituminized paper water pipe mentioned by Trautwine in his "Engineers' Pocket-Book?" *James P. Edwards, Haughton, Mich.*

Diligent inquiry has failed to find bituminized paper water pipe on the market. Mr. John C. Trautwine, Jr., replies to a letter requesting information that "the notice of bituminized paper pipes was inserted by my father in the first edition of our 'Civil Engineers' Pocket-Book,' but I have never been able to find in his notes anything further than in the Pocket-Book."

MACHINE FOR CAULKING WATER MAINS.

Can you give me any information as to the practicability of the A. P. Smith connecting machine for caulking water mains?

J. C. Michie, Durham, N. C.

The O'Neill caulking machine is in use by several cities, and contractors report very good success with it. The advantages claimed for caulking machines over handwork are the ability to reach the under side of the joint, gauging of force of blow and speed, especially for the larger sizes of pipe.

MUNICIPAL CONDUITS FOR ELECTRIC WIRES.

Will you furnish us with names of cities which have constructed and owned conduits for electric wires? *J. C. Jackson, City Clerk, New Castle, Pa.*

While most cities of 100,000 or more and many smaller cities have conduits for both

high and low tension wires, but few cities own the conduits. Among those which own some portion of a system of conduits may be mentioned Chicago, Ill., which owns and operates conduits for public electric lights and for the fire alarm telegraph and telephone systems. These two sets of conduits are independent, but one set is usually laid on one side of each newly improved street and the other set on the other side. Utica, N. Y., owns conduits for electric light wires which it rents to electric light companies at 3½ cents per foot of conduit per year. Duluth, Minn., is proposing to construct a short conduit under a street crossing; Baltimore, Md., possesses some. This list can doubtless be extended somewhat if our readers will send us additions to it.

CONDUITS FOR ELECTRIC WIRES.

What cities under 100,000 population have electric light or power wires underground? Is it feasible to put a system using alternating current for lighting and power underground? What are some good books on underground electric construction?

E. G. Truehcart, City Engineer, San Antonio, Tex.

Many electric light and power wires are put underground without difficulty, of all the principal systems in use. Among these may be mentioned the following: Bloomington, Ill., is just getting all wires in the business portion of the city underground in conduits owned by the light, telephone and telegraph companies. One company has constructed a conduit placing high tension wires in ducts on one side of the trench, steam heating pipes in the center and low tension wires in ducts on the other side. Elgin, Ill., passed an ordinance requiring both high and low tension wires to be placed underground. Fort Wayne, Ind., has a few conduits, for both classes of wires in newly improved streets. Utica, N. Y., owns conduits for electric light wires which it rents to lighting companies at 3½ cents a foot a year. Duluth, Minn., proposes a short conduit divided into two sections by a 6-inch concrete wall, one section being for high tension electric light cables and the other for low tension, telegraph and telephone cables. This list can doubtless be extended, and our readers are requested to send in particulars of additions which they may be able to make to it. Many smaller cities have conduits for telephone wires.

A. V. Abbott's "The Electrical Transmission of Energy, a Manual for the Design of Electric Circuits" ($4.50), has a chapter on underground construction. John W. Lee's "Abridgment of Patents on Underground Lines," 1886 ($10), is doubtless somewhat out of date unless new editions have been issued. R. A. Stuart's "Electric Light Cables and the Distribution of Electricity" ($2.25) is an English book on the subject.

STANDARD FOR REJECTION OF MACADAM STONE.

The following from the United States laboratory for testing road material at Washington will be of interest in connection with the question appearing under the same heading on page 22 of MUNICIPAL ENGINEERING for July, 1901.

"In glancing over a copy of MUNICIPAL ENGINEERING for July, I read with much interest the following question:

'Our specifications call for macadam stone of a certain kind, or stone equally as good. In the standard abrading machine, 5 hours, 10,000 revolutions, the standard stone lost 4.2 per cent. and another stone lost 4.85 per cent. Is the greater loss sufficient to reject this stone?'

"You were quite right in your reply in stating that the difference in the condition of moisture in the two samples of rock might account for the small difference in their results. In making abrasion tests at this laboratory, the samples are kept in a hot air bath (110° C.) until their weights become constant, both before and after the test is made, to eliminate the error arising from moisture. Notwithstanding this and many other precautions to insure uniform conditions, samples of the same rock will sometimes vary as much in their results as the two samples given above.

"It seems to me that when a selection has to be made between two rocks of such slight difference in resistance to abrasion, that there are other considerations which should govern the choice. If the cementing value, hardness, toughness and cost of the two rocks were obtained, and a record of the volume and character of the traffic on the particular road to be constructed were made, the question of choice would be both simple and accurate."

Logan Waller Page,
In charge of Road Material Laboratory, Bureau of Chemistry, U. S. Department of Agriculture.

MUNICIPAL MATTERS IN COURT.

[Prepared for MUNICIPAL ENGINEERING MAGAZINE by Andrews & Murdoch.]

Washington Lien For Improvements—2, Ballinger's Ann. Codes and St., sec. 5902, giving a lien on the property to any person who, at the request of a property-owner, improves a street or road on which such property abuts, is not unconstitutional, as being a taking of property without due process of law. Young vs. Borzone et ux., 66 Pac. Rep. (Wash.) 135.

Assessments Against Abutting Owners—Where the assessment for paving a street against an abutting property-owner is correct, the fact that another abutting property-owner has paid more than his share does not entitle the former to a credit for a portion of the excess so paid, in an action by the contractor to establish a lien on the property of the former. Young vs. Borzone et ux., 66 Pac. Rep. (Wash.) 135.

Sewerage Constituting Nuisance—Although municipal authorities may have plenary powers in the matter of establishing a sewerage system for a city, they cannot lawfully create, in connection therewith, a nuisance dangerous to life or health; and, when necessary and proper, a court of equity will, at the instance of a citizen injuriously affected thereby, enjoin the maintenance of the same. Mayor, etc., of city of Waycross et al. vs. Houk, 39 S. E. Rep. (Ga.) 577.

Duty of Officials to Abolish Nuisance—While, in the present case, a local board of commissioners may have had exclusive control over the sewerage system of the city, it was, nevertheless, the duty of the mayor and council to abate a nuisance such as that complained of, and they were properly held accountable for the maintenance thereof, notwithstanding they may not have been responsible for its creation. Mayor, etc., of City of Waycross et al. vs. Houk, 39 S. E. Rep. (Ga.), 577.

Duty of Water Companies to Supply All Consumers—The acceptance by a water company of its franchise carries with it the duty of supplying all persons along the lines of its mains with the commodity which it was organized to furnish, on equal terms and under uniform rates; and in the absence of legislative regulations, it is competent for courts of equity to interfere to protect the public against unreasonable charges and discriminations. City of Mobile et al. vs. Bienville Water Supply Co., 30 So. Rep. (Ala.), 445.

Disposition of Excavated Earth.—Under the Washington statute authorizing a counter-claim against the assignor of a chose in action to be pleaded in action by the assignee thereon, a property-owner may counter-claim damages resulting from the act of a paving contractor in placing earth excavated from the streets on the lot of the former, in an action by the assignee of the contractor to establish a lien on the property. Young vs. Borzone et ux., 66 Pac. Rep. (Wash.) 135.

Obstructing Business; Liability of Contractor.—A contractor with a city for a public improvement is not liable for substantial damages to an individual because of a structure erected in connection with such improvement in front of plaintiff's hotel, thereby injuring the business of plaintiff, unless it appears that the work was negligently or unskillfully performed, or that the private rights of plaintiff have been unreasonably encroached upon. Bates vs. Holbrook et al., 71 N. Y. Supp. 1,013.

Alteration of Contract.—Where a contract between property-owners and a contractor for the grading of a street provides that each property-owner is to pay in proportion to his interest in the abutting property, the interlineation of the clause, "Each party hereto to pay only such part of the total cost as his front footage bears to the total frontage improved in said street," is not such an alteration as will avoid the contract. Young vs. Borzone et ux., 66 Pac. Rep. (Wash.) 135.

Liability For Defective Sewer—Permitting a public city sewer to be or remain a nuisance, with resulting injury to realty, gives a cause of action against the municipality in favor of the owner of such realty, and on the trial thereof he may recover for all damages to his property which have occurred within four years of the filing of his petition. This is so without regard to the time when the sewer was constructed, or when it became in fact such a nuisance. Massengale vs. City of Atlanta, 39 S. E. Rep. (Ga.) 578.

Diversion of Water—Where a city, under legislative authority, has impounded certain streams tributary to a river for its water supply it is not liable for damages resulting from the water thus diverted to a manufacturer on the river thirty-two miles below, employing both steam and water power, it appearing that at low water the water thereafter flowing in the river was a thousand times the amount diverted, and that the amounted diverted would create less than two-horse power in a working day, and that the manufactur-

er's dam is leaky and has been permitted to remain in that condition for a long period of time. Summer vs. City of Gloversville, 71 N. Y. Supp. 1088.

Working Details; Restrictions by Engineers—A contract between a contractor and the owner of property abutting on a street required the former to grade, curb and sidewalk the street according to the plans of the city engineer, and under his directions, but the plans were not attached to the contract. Held, that the working details of the work, which were prepared by the engineer, became a part of the contract, but that it did not include provisions inserted therein by the city engineer forbidding the contractor to assign the contract, fixing a time in which the work should be completed, and providing for a reduction in the contract price if not completed within such time, as they were not a necessary part of the working details. Young vs. Borzone et ux., 66 Pac. Rep. (Wash.) 135.

Entry of Premises for Survey.—A civil engineer in the employ of the board of public works of the city of New York, who, under the contract of the president of the board, entered on plaintiff's premises for the purposes of making a survey, preliminary to making a map of the city of New York, as required by Greater New York charter (Laws 1897, Chap. 378), is not guilty of a trespass for which a recovery could be had, unless he abuses his authority; since Sec. 422 of the charter declares that it shall be lawful for the president of the board of public improvements, and all others acting under his authority, to enter in the daytime onto and upon the lands of others, which he shall deem necessary to be surveyed, etc., for the purpose of marking any boundary line or lines. Edwards vs. Law, 71 N. Y. Supp. 1097.

Pollution of Stream by Sewerage.—The channel of a creek was changed by a city so that it ran to a neighboring lake. The city proposed to build an additional sewer connecting with the creek and emptying near the land abutting on the lake, and thereby increasing the pollution of the creek and lake. Held, that such act will be restrained, where it appeared that the land was flooded at the time of the spring floods, and large sewage deposits made, which became extremely offensive when the waters receded. That abutting owners on a stream have not objected to the use of the stream as a sewer does not estop them from objecting where the city proposes to increase such sewer. Cale et al. vs. City of Syracuse et al., 71 N. Y. Supp. 986.

Erection of Electric Light Poles in Boroughs—Electric light companies organized under the general corporation act of this state have authority to erect poles and to string and maintain wires in the public highways upon first obtaining the consent of the owners of the soil. The proviso of the act of 1896, declaring that no poles shall be erected in any city or town without first obtaining a designation of the street in which the same may be placed, and the manner of placing the same, does not extend to boroughs. The borough act (P. L., 1897, p. 296) empowering borough councils by ordinance to regulate the streets of the borough, to remove obstructions and nuisances therefrom, and to prescribe the manner in which corporations or individuals shall exercise any privilege granted to them in the use of the streets, confers a power which can only be exercised by the passing of an ordinance. Until the borough council does pass an ordinance regulating the use of borough streets, or prescribing the manner in which electric light companies shall exercise their street privileges, an electric light company which has obtained the consent of the owners of the soil may string its wires in the public streets of the borough. Point Pleasant Electric Light and Power Co. vs. Borough of Bay Head et al., 49 At. Rep. (N. J.), 1108.

Establishment of Sewers—The records of the city council of the city of Biddeford clearly established the fact that the common council originally opposed the construction of the sewer in question, while the mayor and aldermen insisted upon the proposition to build it, and through a committee of conference finally succeeded in procuring the assent of the common council. The oral evidence satisfactorily shows that it was constructed by the street commissioner, at the expense of the city, under the immediate direction of the mayor and aldermen. Held, that this action of the mayor and aldermen was not invalidated by the superfluous assent of the common council. While the sewer complained of continued to be used for the flow of the drainage designed to pass through it, it was the duty of the city to maintain and keep it in repair; and although no action lies for a defect or want of sufficiency in the plan or system of drainage adopted in the exercise of a quasi judicial discretion, under powers specially conferred

by statute, the duty of keeping the common sewers in repair and free from obstruction after they have been constructed, and have become the property of the city under such authority, is a ministerial duty, for neglect of which the city is liable to any person injured. The same is true of the duty actually to construct them with reasonable care and skill; and there is no difference in these duties, whether the city has acquired the right to maintain the sewer by prescription, or has laid it under the statute. The plaintiff had no private drain connected with the sewer in question, and was not entitled to drainage through it according to the provision of the statute; but he sustained damage by reason of the injury to the foundation of his stable and the land across which the sewer was laid, caused by the neglect of the city to keep the sewer in proper repair, and this, upon obvious principles of justice, as well as upon authority, he is entitled to recover in this action. Hamlin vs. City of Biddeford, 49 At. Rep. (Me.) 1100.

CURRENT INFORMATION.

Meeting of Municipal League of Indiana.

The Municipal League of Indiana held its semi-annual meeting at Anderson, Oct. 9, 10 and 11. An excellent program, containing representatives of all the branches of municipal government, had been prepared by the program committee, especial credit for which is perhaps due to President George E. Downey, mayor of Aurora, and to the local representative of the organization, G. M. Ballard, city attorney of Anderson. The program as actually presented was quite sufficient to fill the time of the convention, the only department failures in the way of papers being those of the engineers and the councilmen. The most interesting discussions to the members were those upon the new street improvement law for cities, the proposed municipal charter, and city forestry. This was probably the most successful convention in the history of the league.

The convention was called to order promptly on Wednesday afternoon. The usual invocation, address of welcome by Mayor M. M. Dunlap, and response by the president were followed by an extemporaneous analysis of the new street improvement law by Warren N. Hauck, city attorney of Lawrenceburg. This was made in considerable detail, and showed a careful study of the statute. The speaker and all those following united in condemning the law as the most difficult to administer, causing the most expense and the least satisfactory of any ever in use in the state. Many questions were asked regarding the details of application of the law, which showed the indefiniteness of some of its provisions, and the point was made that a law like the Barrett law, which has been on the statute books long enough to have been interpreted by the courts, should not be superseded as a whole by a new measure, no matter how well digested, which cannot be considered safe to follow until it has been passed upon by the courts of the state. A paper by John Wilhelm, city attorney of Vincennes, upon the same subject was read by City Attorney Brock of Jeffersonville, and the discussion was led by G. M. Ballard, city attorney of Anderson.

The evening session, in the absence of the speaker appointed, was given up to discussion of points brought forward in reports from meetings, immediately preceding, of the representatives of various departments of city government. Though informal, this meeting was quite valuable, especially in informing the members of the customs of other cities.

On Thursday morning the municipal charter prepared under the auspices of the Indiana State Board of Commerce was discussed by J. E. McHenry, mayor of Wabash; A. P. Beatty, mayor of Decatur, and others. There were more dissenters among the speakers than supporters of the measure, but most of the objections were shown to be based upon lack of information regarding the provisions of the bill and misunderstanding of its statements. Thomas R. Jessup, city attorney of Richmond, spoke upon the subject of City Forestry and started an interesting discussion by persons interested in the work and having some experience. All agreed that the trees of a city should be placed under expert supervision and that planting and trimming should not be done indiscriminately, but, singularly enough, followed the statement of the first speaker that the matter should be directly in the hands of the council, a non-expert, changing body, instead of in the hands of the park board or a tree commission, presumably appointed for their special qualifications in this kind of work and having an expert forester or park superintendent in its employ.

Thursday afternoon was devoted to an address by Governor W. T. Durbin, and a paper by George A. Har-

rison, superintendent of police, Lafayette, on "Municipal Enforcement of Law for the Suppression of Vice." The difference in spirit of the two addresses can be judged to some extent by comparing Governor Durbin's statement that "one of the most important lessons to be inculcated in the minds of the people is that laws are made to be enforced, not to be construed to suit conditions, not to be juggled, not to be trifled with," with some of Mr. Harrison's sentences expressing the opinion that the extent to which the officials should go in enforcing the laws regulating the sale of liquor must depend upon the temperament of the community; that gambling cannot be suppressed, but it can be restricted to the "square" gambling. There was also a short discussion upon the possibility under the law of the purchase and operation of hot-water heating plants by cities. Mayor Beatty expressed his opinion that the statutes did not expressly authorize it and it could therefore not be done. Mayor B. F. Deahl of Goshen inclined to the same opinion, though the wording of the law authorizing municipal ownership and operation of water works was slightly changed by the last legislature with the idea that the change made would permit the inclusion of hot-water heating plants in the class of water works.

The evening session was occupied by a paper on "The Municipal League of Indiana, Its Past, Present and Future," by William Dimond, Huntington, read by City Attorney France, and by reports of the Committee on Revision of Laws and on preparation of forms for resolution, contract and bond for use of cities under the new street improvement law. A committee of five to codify the laws relating to municipalities and recommend a general form for law governing cities as a result of this codification was ordered. One of the valuable features of the league is the opportunity to adopt and recommend forms for city papers such as those mentioned, thus enabling all cities to profit by the experience of any one city in the courts by reason of the uniformity of the methods of procedure. The society then adjourned to a smoker and enjoyed a social hour.

On Friday morning some unfinished business was disposed of, Vincennes was chosen as the place of meeting in May and George E. Greene, mayor of Vincennes, was chosen as the local or corresponding secretary. The proceedings of the convention were ordered printed. Some consideration of the league will be found in the editorial department.

The officers are George E. Downey, mayor of Aurora, president; Loring W. Mellett, Elwood, treasurer; Z. T. Dungan, mayor of Huntington, permanent secretary.

The following persons were registered:

Anderson—W. W. Atherton, Councilman; G. M. Ballard, Attorney; M. M. Dunlap, Mayor; W. S. Ellis; F. G. Epply, Clerk; S. M. Keltner; Charles Kemery, Treasurer; Thomas McCullough, Police Clerk; H. H. Rogers, Engineer; Frank A. Sharp, Deputy Clerk and Treasurer; L. A. Stephens, Councilman.

Aurora—George E. Downey, Mayor; Philip Horr, Treasurer; John Jobst, Marshal; Charles Martin; D. B. Teaney; H. C. Westmeier; H. Wunderlich.

Bluffton—W. H. Fox, Marshal; James B. Plessinger, Mayor.

Columbus—R. T. Dixon, Police; F. W. Fehring, Treasurer; J. F. Foormehlen, Councilman; Cornelius Hayes, Deputy Marshal; Frank Hoffman, Police; A. C. Kelble, Councilman; George Smither; Christoph Vollmar, Marshal.

Decatur—A. P. Beatty, Mayor.

Delphi—A. L. Gurley, Marshal; Hiram Kerlin, Mayor.

Dunkirk—George T. Whitaker, Attorney.

Elwood—James J. Davis, Clerk; John Finan, jr., Engineer; L. W. Mellette, ex-Attorney; John W. Pertz, Councilman; M. M. Sue, Chief of Fire Department.

Ft. Wayne—E. C. Miller.

Goshen—B. F. Deahl, Mayor.

Greensburg—Ed Dille, Councilman; Thomas M. Gannon; S. B. Hitt, Councilman; Marsh McCormick, Councilman; Alfred McCoy, Councilman; John Pierce, Councilman; H. C. Skilman, Attorney; M. C. Welsh, Councilman.

Hartford City—A. F. Kinsley, Mayor.

Huntington—W. Dimond, Superintendent of Police; J. Fred France, Attorney; R. B. Fulton, Councilman; W. H. Prill, Councilman.

Indianapolis—Charles Carroll Brown, Editor Municipal Engineering.

Jeffersonville—Charles Akers, Councilman; Charles Antz, Councilman; James T. Applegate, Chief of Police; H. L. Brendle, Councilman; Thomas J. Brock, Attorney; William H. Clegg, Councilman; W. B. Hassan, Clerk; Thomas B. Rader, Mayor; C. A. Schimpff, Police Board; A. O. Schuler, Councilman.

Lafayette—G. A. Harrison, Superintendent of Police.

Lawrenceburg—W. N. Hauck, Attorney; T. W. Kestner, Councilman; George Kunz, Councilman; Ernst Meyer, Councilman; W. H. O'Brien, Mayor.

Logansport—George E. Barnett, Treasurer; W. T. Giffe, Councilman; W. A. Osmer, Engineer; J. P. Slaybaugh, Councilman.

Madison—George W. Distel, Councilman; George F. Harper, Clerk; E. D. McGuire, Mayor; L. M. Robinson, Treasurer; N. Roeder, Councilman.

Peru—J. B. Sellitt, Special Agent of Wabash Railroad.

Portland—H. C. Ayers, Councilman; Isaac Simmons, Mayor; Will M. Stephens, Police.

Richmond—Thomas R. Jessup, Attorney; Henry Kehlenbrink, Councilman; B. A. Kennepohl, Councilman; Edgar Norris, Councilman; W. P. O'Neal, Councilman.

Seymour—A. W. Mills, Mayor.

Terre Haute—Charles E. Hyland, Superintendent of Police; Henry C. Steeg, Mayor.

Tipton—M. Bath, Treasurer; J. B. Coleman, Attorney; A. J. Douglass, Street Commissioner; J. W. Harris, Councilman; John Langan, Superintendent of Water Works; J. A. Lewis, Councilman; G. W. Myerly, Councilman; A. F. Newlon, Councilman; F. Waffler, Councilman.

Vincennes—Thomas Dunn, Superintendent of Police; George E. Greene, Mayor; John Wilhelm, Attorney.

Wabash—Oliver H. Bogue, Attorney; J. E. McHenry, Mayor.

Warsaw—Bertram Shave, Attorney.

Winchester—F. W. Hutchens, Mayor.

Basement Walls of Concrete.

A contractor gives the following method of making forms for basement walls in concrete and the proportions and method of placing the materials used. The figures for cost which he gives are of course applicable only to the same circumstances. Ordinarily the materials which he obtained only at the cost of handling and for which he has made no allowance except for labor must be paid for and the difference in cost from brick works will be materially reduced. He says:

We use plank 16 feet long, 2 inches thick and 12 inches wide. Two planks are bolted with three iron bolts so that the space between the planks is 12 inches. These planks are laid lengthwise on the ground where the wall is to be built. We fill in between the planks with a mixture of one part cement and three parts coarse sand or pebbles. This mixture is poured, in slush form, and then boulders or "nigger heads" are dropped in. When the space is filled more plank is put on and the lower set is removed, and so on till the proper height is reached. I would advise using wood pins through the wall where you may want to put in pipes for water, gas or sewer, as it is almost impossible to penetrate the mixture after it has set hard.

The wall I am now building stands 10 feet high, 2 feet being above ground. This part will be marked to imitate stone.

The running length of the wall is 110 feet. Cement and labor cost $100. The sand, pebbles and "nigger heads" are found on the ground. A brick contractor asked $180 for an eight-inch wall. I saved $80 and consider I have a better wall, and it is twelve inches thick

The Production and Use of Cement in the United States.

The last volume of the report of the United States Geological Survey on the mineral resources of the United States gives statistics of the production of natural and Portland cements by states, by methods of manufacture, by years, and by districts, showing the enormous development of the industry in all its branches. Notwithstanding this great increase there was a reported shortage of cement in the last full year (1899) covered by the report. The most striking table in the report is presented at this time. Further consideration of its other interesting statements will be given later.

Total Consumption of Cement in the United States to January, 1, 1900.
(Barrels.)

Year.	Natural-rock cement.	Imported Portland.	Domestic Portland.
To 1830	300,000	.....	.....
1830-40	1,000,000	.....	.....
1840-50	4,250,000	.....	.....
1850-60	11,000,000	23,160	.....
1860-70	16,420,000	21,715	.....
1870-80	22,000,000	748,406	82,000
1880	2,030,000	187,000	42,000
1881	2,440,000	221,000	60,000
1882	3,165,000	370,406	85,000
1883	4,190,000	486,418	90,000
1884	4,000,000	585,768	100,000
1885	4,100,000	554,396	150,000
1886	4,186,152	650,032	150,000
1887	6,692,744	1,070,400	250,000
1888	6,253,295	1,835,504	250,000
1889	6,531,876	1,740,356	300,000
1890	7,082,204	1,940,186	335,000
1891	7,451,535	2,988,313	454,813
1892	8,211,181	2,440,654	547,440
1893	7,411,815	2,674,149	590,652
1894	7,653,488	2,638,107	798,757
1895	7,741,077	2,997,395	990,324
1896	7,970,450	2,989,597	1,543,023
1897	8,311,688	2,090,924	2,677,775
1898	8,418,924	2,013,818	3,692,284
1899	9,868,179	2,108,388	5,652,266
Total	178,589,608	33,376,692	18,841,334

Asphaltic Sandstone in Missouri.

Some samples of the asphalt sandstone quarried at Liberal, Mo., have been received which show a homogeneous mass well impregnated with asphalt. The stone occurs in ledges two to five feet in thickness, the upper layer being covered by two to ten feet of soil. About 90 acres of area is known to be underlaid with the stone and a quarry face 350 feet long has been exposed. The stone is quarried with a channeling machine in blocks weighing from ten to twenty-five tons and sawed to size and form desired with a stone saw gang. The use of the stone for street paving has been suggested.

Asphalt in Texas.

H. C. Alford, an asphalt and petroleum expert of St. Louis, in the interest of the St. Louis Oil and Asphalt company, has reported upon the asphalt fields of St. Jo, Montague county, Tex. He believes that the St. Jo asphalt district is a continuation of

the asphalt districts of the Indian Territory. The samples of asphalt examined contained from 30 to 45 per cent. of petroleum, while in the crude material in the outcrops he found from 60 to 75 per cent. Indications point to petroleum at a depth of about 1,500 feet. Mr. Alford believes, however, that the oil will have a very slight asphalt base, very little paraffin, and will probably be a fair illuminating oil with a minimum of sulphur.

The Production of Asphalt in the United States.

From the twenty-first annual report of the United States Geological Survey on the mineral resources of the United States the tables presented herewith are taken, the first showing the production of the various kinds of asphaltic material in this country for each of the last four years and the second the total imports of asphaltum from other countries for each of the last three years covered by the report.

The report goes into considerable detail regarding the production of asphaltum in various states and territories and in other countries. The total production in this country is very nearly the same from year to year. The imports fluctuate between quite wide limits. Other tables in the re-

Varieties of Asphaltum, etc., Produced in 1896, 1897, 1898 and 1899.

Variety.	1896.		1897.		1898.		1899.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
Crude asphaltum	6,500	$78,000	5,971	$71,404	11,300	$179,900	10,894	$227,480
Bituminous sandstone	56,971	170,913	48,801	158,914	43,624	126,831	43,041	121,023
Bituminous limestone, *a*	4,300	21,500	2,100	10,600	5,502	26,412	15,650	79,500
Mastic	100	900	483	9,864	1,158	17,840	.....	.....
Hard and refined or gum *b*	3,122	92,240	3,940	102,500	1,878	53,666	4,800	116,250
Liquid or maltha	9,510	214,010	14,650	311,350	12,875	271,000	700	9,651
Total	80,503	$577,563	75,945	$664,632	76,337	$675,649	75,085	$553,904

a Not including mastic or refined asphaltum made from bituminous limestone.
b Including gilsonite from Colorado and Utah and Ventura from California.

Imports of Asphaltum During the Fiscal Years 1897, 1898 and 1899, with the countries from which exported.

Country.	1897.		1898.		1899.			
	Quantity.	Value.	Quantity.	Value.	Rock or dried, etc.	Value.	Crude.	Value.
	Long tons.		*Long tons.*		*Long tons.*		*Long tons.*	
West Indies: British (Trinidad)	85,034	$198,786	71,992	$217,660	224	$3,471	68,692	$195,637
Danish	400	2,000	.....	.....	.....	.....	.....	.....
Cuba	223	4,180	137	2,172	.....	.....	109	2,090
Switzerland	.....	.....	98	530	837	7,653	.....	.....
Italy	*a*14,581	*a*77,456	1,260	7,531	6,443	28,276	.....	.....
Venezuela (Bermudez)	13,807	75,943	2,000	10,006	8	102	3,601	18,010
Germany	6,896	25,986	2,302	9,066	1,228	6,366	254	1,449
France	861	3,327	779	3,377	648	2,539	1	77
Spain	.....	.....	.....	.....	.....	.....	700	7,000
Mexico	273	3,992	438	5,773	.....	.....	32	714
Turkey in Asia	31	3,439	41	3,744	.....	.....	84	8,770
Great Britain	11	309	13	597	11	613	12	384
United States Colombia	3	130	.....	9	.....	.....	.....	.....
Canada	2	6	.....	.....	.....	.....	3	80
Netherlands	.....	.....	.....	.....	.....	.....	6	209
Total	122,122	$395,554	79,060	$260,765	9,399	$49,020	73,494	$234,420

a Probably including Switzerland.

port do not agree very closely with the detailed report of imports here given, and the explanation of differences is not made sufficiently definite to show the reasons for these differences.

Burned Clay Ballast.

The following description of the method of making and using burned clay for railroad ballast may be of interest in those sections where road material is scarce and expensive. While the burnt clay will be far from giving as good satisfaction on highways as on railroads for ballast it may sometimes be much better than no hard material. The description is taken from a paper by W. Shea of the Chicago, Milwaukee & St. Paul Railroad before the meeting of the Roadmasters' and Maintenance-of-Way Association at Washington, Oct. 8 and 9.

In detail the cost per cubic yard of this ballast on cars is as follows: Land, interest on track material, track labor and stripping, 4 cts.; coal, 13½ cts.; burning, 17½ cts.; loading, by hand, 7 cts.; total, 42 cts. per cubic yard.

Cost of ballast depends largely upon cost of coal. In favorable season a ton of coal will burn about four cubic yards of ballast, using gumbo soil. The weather has a great deal to do with amount of coal used to burn a yard of ballast. During a wet, bad season a ton of coal will not burn as much ballast as during a hot, dry season.

A good quality of fancy steam coal or slack and nut mixed should be used, as it makes a better fire and the heavy rains do not have the effect on the fire that they would if using slack coal.

The best burnt clay ballast is made out of gumbo soil, but clays can be used. You can burn as many yards of ballast in a day on 2,000 feet of fire in gumbo soil as you could on a 3,000-foot fire in clay. The gumbo, having more vegetable matter, will burn more quickly and cool off more rapidly than clay.

The cost of hauling and unloading burnt clay ballast is practically the same as gravel. The cost of putting it under the ties is also about the same as good gravel ballast.

I consider good burnt clay ballast very efficient for maintaining track, and can maintain a better riding track on it cheaper than with rock ballast. Screened rock ballast is stronger, without a doubt, but the clay ballast is handled so much easier and quicker than the rock that on the whole I consider it a better ballast than rock for a line with ordinary traffic.

We have some track in the Medicine Creek bottoms in North Missouri that was ballasted twelve years ago; part of it was ballasted with rock and the balance with burnt clay. We put from eight to ten inches of ballast under the ties in both cases. Our burnt clay track has always been in the best repair, considering the amount of work done on the track. The life of the clay ballast seems to be about as long as the rock.

We have got the best results from burnt clay ballast by using it to cover worn-out stone ballast. We put from six to eight inches of clay ballast on top of the stone, and it makes an ideal track.

After the clay ballast has been laid under the ties and you get a good rain on it, there will be no more dust than on a rock-ballasted road. Weeds can be cleaned out of clay ballast for one-quarter the cost that they can out of rock. Ties can be renewed in clay ballast for 40 per cent. less than in rock ballast. The life of a tie in burned clay ballast is 10 per cent. longer than in rock. I account for this because the clay is porous and dries out quicker, then draws the dampness out of the tie.

In laying burnt clay ballast we tamp it with shovel blades, but our section gangs, where they are picking up low joints, etc., and do not lift track over an inch, tamp with tamping picks. Some may imagine that by using picks you injure the ballast, but in my experience of twelve years I could not see that it damaged the ballast, and we can keep a better surface on track by so tamping. We dress and shoulder our burnt clay ballasted track same as good gravel ballasted.

Brick and Stone Streets for St. Louis.

George R. Grimes, who has been superintending the construction of brick streets in St. Louis, the contract for which was secured by Voorhees & Grimes of Terre Haute, Ind., stated recently that the city officials of St. Louis, after experimenting many years with asphalt, wooden and creosoted blocks, brick and granite blocks, have decided to use only brick and granite blocks for the streets that will be paved next year.

Clean Streets and Smokeless Chimneys Demanded.

In a recent address before the American Park Association, Prof. George Kriehn said:

The aim of municipal art is to realize that dream of the artist and poet—the city beautiful. This it does by the application of art to the city; to all parts of the city, from the slum alley to the boulevard, the cottage to the palace—and to every kind of city, from the hamlet to the metropolis. The American city is built primarily for utilitarian purposes, as a place of traffic and of residence, and with litttle regard for appearances. It will indeed require a great effort to transform it into a place of beauty.

But the change will not be so great as might at first thought be imagined. Viewed collectively, the city's elements of ugliness seem appalling, but take them up singly and the possibility of improvement is more apparent. There is much in our cities that is beautiful and well worthy of preservation, but it is so surrounded by distracting elements of ugliness that we often fail to see it.

The first step, therefore, is to remove these obstructions so that we can take an inventory of what is really available for the construction of our city beautiful. Among these are dirty streets and a smoky atmosphere. Cleanliness is indispensable in the modern city, and there is

no use trying to construct beautiful buildings which in a few days would be so covered with soot as to be almost unrecognizable. But as municipal reformers have already taken up the questions of clean streets and smokeless chimneys with some hope of success, the advocates of municipal art, while strenuously seconding their efforts, have turned their attention to more neglected questions.

Public Work in Washington, D. C.

The annual report of W. J. Douglas, engineer of bridges of the District of Columbia, states that the expenditures under the head of ordinary care of bridges came within the appropriation of $4,000 by the narrow margin of $4.03. He says the bridges are generally in good condition with the exception of the Navy Yard or Anacostia bridge, No. 55, which has been considered structurally weak, and particularly so since the employment of the heavy motor cars of the Anacostia railway company. The sum of $40,000 was appropriated toward the construction of a bridge across the Rock Creek on the line of Connecticut-ave. extended, and $5,000 for continuing the construction of a bridge across Rock Creek on the line of Massachusetts-ave. extended, the work on both of which is now under construction. Mr. Douglas recommends appropriations for the fiscal year ending June 30, 1903, as follows:

For the ordinary care of bridges, $4,000; for the construction and repair of bridges, $25,000; for Anacostia bridge (for necessary borings, surveys, estimates and plans), $3,000; for K-st. bridge over Rock Creek (reconstruction), $20,000; for Connecticut-ave. bridge over Rock Creek (for continuing construction), $200,000.

Estimates of funds required for maintenance and construction by the sewer division for the fiscal year 1902-1903 have been submitted to the district commissioners by D. E. McComb, superintendent of sewers. The sum of $58,000 is asked for cleaning and repairing sewers, the total being divided as follows:

Cleaning tidal sewers, $5,000; cleaning pipe sewers, $4,000; cleaning catch basins, $12,000; flushing sewers, $5,000; repairs, $23,000, and operating temporary sewage pump, $8,000.

His estimates for the extension of the sewer system and relieving sewers call for $42,000; for the construction of catch basins, $8,000; for the extension of suburban sewers, $50,000; for automatic flushing tanks, $1,000; for the purchase and condemnation of rights of way for construction, maintenance and repair of public sewers, $1,000; for continuing work on the Arizona avenue sewer, $75,000 (amount heretofore appropriated, $105,000); for the extension of the Boundary sewer to the vicinity of 22d and A streets northeast, $75,000 (heretofore appropriated, $125,000); for continuing the construction of sewer between 22d and A streets northeast and 12th street southeast, $50,000 (heretofore appropriated, $100,000); Ivy City trunk sewer, $50,000 (no appropriation heretofore made for this work).

Mr. McComb asks for an appropriation of $375,000 for continuing on the big sewage disposal station at the foot of New Jersey avenue S. E. and for the purchase of machinery therefor. For the low area trunk sewer leading to the station he asks $60,000. He recommends for insertion in the appropriation bill the following clase:

"Any balance of former appropriations remaining after the execution of contracts for works of the sewage-disposal system may be applied by the commissioners of the District of Columbia in the execution of other portions of the said sewage-disposal system."

The attention of the board of commissioners of the District of Columbia was recently called to the case of Mrs. Mary I. May, who was served with notice and presented with bills for special assessments for benefits in the condemnation proceedings for widening Columbia road and Sixteenth-st. The bills bear interest upon their face from July 9, 1901. Mrs. May called at the district building about July 28 or 29 and was prepared and wished to pay the amounts due, but was informed that the bills had not yet been prepared. They were served upon her for the first time Sept. 30, 1901. Commissioner John W. Ross says that Mrs. May is willing and anxious to pay, but does not deem it proper that she should be charged with interest when she was prepared to pay in July, but could not because the bills were not ready. The special assessment clerk stated that the act of congress under which the assessments were levied provided that interest should be charged from the date of confirmation of the award of the jury by the court. The papers in the case did not reach the special assessment office until Sept. 4, and the bills were served at the earliest date thereafter.

The matter was referred to A. B. Duvall, attorney for the district, who states in an opinion submitted to the commissioners that the commissioners are not at liberty to disregard an unequivocal act of congress, however clear it may be to them that its provisions were improvidently inserted. He says the practical situation is one that should be relieved, but relief can only come through further legislation by congress. He suggests that the commissioners recommend to congress that the provision respecting the charge of interest in all the street extension condemnation cases be changed so that interest will be chargeable only from and after sixty days or some

longer time after the final confirmation of the awards in such cases and that there be refunded to parties who have paid under written protest interest on these assessment for such period.

Federal Court Cannot Enjoin Enforcement of State Law.

The Supreme Court of Nebraska holds that the federal courts are without power or jurisdiction to enjoin a state from the enforcement of its own laws. The attorney-general of Nebraska brought suit against a railroad corporation, and then presented a motion to dismiss the case for the reason that he had been enjoined by the United States court from the prosecution thereof. The court decided that the attempted restraint of the attorney-general by such court was an attempt to restrain the state itself, and what the court cannot do directly it may not do indirectly.

French Fuel Briquettes Made From Garbage.

A process has been discovered in France by which garbage is converted into briquettes, which consists in mincing the refuse from abattoirs, fish markets, etc., straw, paper, etc., and adding tar and napthalene. The mass is then mixed in a kneading apparatus, dried, and pressed into briquettes. The briquettes have a slight odor of gas, burn brightly and engender heat slowly, it is claimed, and with a more highly perfected method of manufacture they will produce less ash, and the heat-producing qualities will be about the same as those of common coal. They will also possess the advantage of burning slowly and developing no smoke.

South Carolina Cities Can Issue Additional Bonds.

The South Carolina supreme court rendered an opinion Oct. 7, whereby the authorities of Florence can proceed with the preliminaries incident to the issue of additional bonds for municipal indebtedness. A petition for injunction against the city officials was largely based upon the error that was made in the printing of the tickets upon the constitutional question relative to the increase of municipal indebtedness by the cities of Florence, Charleston, Columbia, Georgetown and other places. The supreme court, after hearing the arguments, "dismissed the petition per curiam," stating that the mistake in the tickets is immaterial.

A Municipal Restaurant Proposed in London.

The establishment of a municipal restaurant, where well-cooked meals and pure tea, coffee and liquors can be obtained amid comfortable surroundings at moderate prices is advocated by the British workmen in London. A joint deputation of the London Trades' Council and the Social Democratic Federation will invite the London County Council to make an experiment with one such enterprise in the heart of the city.

The Portland Cement Industry in Michigan.

In the nineteenth annual report of the Michigan Bureau of Labor and Industrial Statistics the manufacture and use of Portland cement will be given a prominent place as one of the great and growing industries of the state. From advance sheets the following is taken:

The completed plants in the state are located as follows: The Alpena Portland Cement Company, two miles east of the city of Alpena, Alpena county; the Elk Rapids Portland Cement Company, one mile south of the village of Elk Rapids, in Antrim county; the Newaygo Portland Cement Company, at the village of Newaygo, Newaygo county; the Coldwater Portland Cement Company, one plant one mile west of the city of Coldwater, and one at the village of Quincy, both in Branch county; the Bronson Portland Cement Company, two miles east of the village of Bronson, in Branch county; the Peerless Portland Cement Company, at the village of Union City, in Branch county; the Peninsular Portland Cement Company, offices in the city of Jackson, plant thirteen miles south at the village of Woodstock, in the northwest corner of Lenawee county; the Omega Portland Cement Company, four miles north of the village of Jonesville, in Hilsdale county. There is also a plant operated by the Michigan Alkali Company at Wyandotte, in Wayne county.

The capital stock of these ten corporations aggregates $7,450,000. The average cost of each plant will be about $465,000 and new improvements and buildings are constantly being added at large expense. The daily capacity of the ten plants aggregates 8,500 barrels of 380 pounds each, or an average for each plant of 850 barrels every 24 hours.

The five plants in process of construction have an authorized capital stock of $8,070,000. It is estimated that their cost will average about $500,000 each, and that their aggregate daily capacity will be over 8,000 barrels. It is intended that three of these factories will be making cement the present season, and the other two will be ready to start early in 1902. They are located as follows: The Great Northern Portland Cement company, two and one-half miles south of the village of Baldwin, in Lake county. This will be one of the largest plants in the world, the output being estimated at 4,000 barrels daily. They have the finest material of all kinds in sight, that will last hundreds of years.

They expect to give steady employment to over 400 persons. The Detroit Portland Cement Company and the Egyptian Portland Cement Company are each located about two miles north of the village of Fenton in Genesee county; the Zenith Portland Cement Company at the village of Grass Lake in Jackson county; the German Portland Cement Company at the village of White Pigeon, in St. Joseph county.

Articles of incorporation have been filed and eight other companies have been organized, the capital stock of which aggregates $8,345,000. Locations have been selected, and the land and lakes containing an abundance of raw material have been secured. Work has been begun on some of the plants, and those most interested are sanguine that they will be put in successful operation. They are located at Bay City, Bay county; Bellaire, Antrim county; Farwell, Clare county; Fenton, Genesee county; Hamburg, Livingston county; Spring Arbor, Jackson county; Kinderhook, Branch county, and Three Rivers, St. Joseph county. The aggregate daily capacity of these plants when built and equipped as contemplated, will be about 10,000 barrels.

Location of Gas Mains in Traverse City Must Be Approved by Council.

A new gas plant is under construction in Traverse City, Mich., under the provisions of a well-constructed ordinance passed in January, 1901. One of the sections of this ordinance provides that "Said main pipes shall be laid in alleys whenever practicable, and when so ordered by the council. Said grantees before laying any such pipes in the streets, alleys, highways and public places in said city, must first obtain permission therefor from the council upon application in writing."

The gas company presented a plan for the pipe system, using streets quite largely instead of alleys, and on failure of the city to approve it, sought to compel such approval by mandamus. A number of questions of fact were submitted to a jury for decision, among the decisions of the jury being that some alleys named are better than streets for the gas mains, but that in most cases the streets were better; that the cost in the alleys would be over $7,000 more than in the streets, which would postpone dividend paying for two and a half years; that 104 more consumers would be reached in the alleys; that the mains could be laid in streets without detriment, present or future, to paving or trees.

After consideration of the answers by the jury and the briefs of counsel, Judge Frederick W. Mayne refused to grant the mandamus, since many of the alleys are better than streets, the company is presumed to have known that the construction in alleys would cost more than in streets when the ordinance was accepted, and that such construction in alleys would probably be required; also, granting the writ would practically strike the section from the ordinance. He suggests the use of cross alleys in connection with a main in Union street. He considers that the company must show that the use of alleys is impracticable, which, he thinks, has not been done.

It is said that the company will appeal to the supreme court.

New York's Franchise Tax Law Is Constitutional.

Justice Botts of the New York supreme court has decided that the franchise tax law is constitutional. The decision was rendered in the matter of the assessed valuation of the Troy gaslight company by the state board of tax commissioners. The proceedings in which these reductions were made were in the nature of certeriorari, and were brought not only for the purpose of reviewing the action of the state tax commissioners relative to valuation, but also to raise the question of the constitutionality of the franchise tax law.

New Industrial Town in Pennsylvania.

The Westinghouse company will commence at once the erection of a new town and foundry plant at Stewart station, on the Pennsylvania road east of Pittsburg. The company has reserved 650 acres, and proposes to concentrate all of its foundries in one plant and build a town around it for the benefit of the employes. The town will be called Trafford Park. The cost of the improvements will be $5,000,000, and over 2,000 men will be employed in the works.

Unnecessary New Curb Need Not Be Paid For.

In an opinion filed Oct. 4 at Lebanon, Pa., Judge Ermentrout held that property-owners cannot be made to pay for recurbing made necessary by asphalt paving if the old curbs are in good condition. The city had constructed several miles of asphalt paving, requiring all property-owners to put in new granite curbs. A number complied, but liens filed by the city against those who failed to comply aggregate $7,000.

A Good Roads Special for the Southern Railroad.

A "Good roads special," consisting of twelve cars, is to be sent out from Washington, D. C., about Nov. 1 over the lines of the Southern Railroad, to stop at ten or twelve of the principal cities reached by that system. The tour will end about Jan. 1, and will include the following municipalities: Danville, Va., Oct. 29; Raleigh, N. C., Nov. 7 and 8; Asheville, N. C., Nov.

12 and 13; Columbia, S. C., Nov. 18 and 19; Greenville, S. C., Nov. 20 to 23; Atlanta, Ga., Nov. 25 to 29; Birmingham, Ala., Nov. 30 to Dec. 4; Montgomery, Ala., Dec. 5 to 10; Mobile, Ala., Dec. 11 to 14; Chattanooga, Tenn., Dec. 16 to 19; Knoxville, Tenn., Dec. 2[illegible]. Sample macadam and dirt roads will be built.

Cleveland's New Water Tunnel Abandoned by Contractors.

Work on Crib No. 3 of the new water tunnel at Cleveland, O., was abandoned Oct. 2 by the contractors, Schailer & Schniglau. Disaster and great loss of life have marked the progress of the work. The contract for constructing the tunnel was let in 1896 to W. J Gawne for $1,000,000, who sublet it to Schailer & Schniglau. It was to have been completed in 1900, but another year's work remains to be done yet, it is said.

Large Wisconsin Drainage District.

In a decision handed down Oct. 8 by Judge Charles M. Webb, in the Remington drainage case at Grand Rapids, Wis., he gives the petitioners permission to drain the marshes. This will result in the opening up for colonization of 600 square miles of marsh land now practically useless, and the land will be drained and converted into farms. The drainage canals will be six and ten miles in length, one to empty into the Yellow river and one into the Juneau county drainage canal.

Sewage Disposal of Mississippi River Cities.

The annual report of Charles Francis of Davenport, civil engineer of the Iowa state board of health, has been filed with Governor Shaw. He states that St. Louis can have no complaint on account of the sewage that passes by St. Louis via canal, for St. Louis is emptying her sewage into the Mississippi to be carried on down past other cities. He thinks it is ridiculous for St. Louis to try to prevent Chicago from venting her sewage as she does. This illustration is used to show in a general way that such a method of disposing of sewage is "wholly wrong, and, as it is entirely unnecessary for this section, it is very nearly criminal." In following out this theory, Mr. Francis applies the principles to Iowa cities, saying that Davenport, where he lives, cannot complain because Clinton, Dubuque, St. Paul and Minneapolis discharge their sewage into the Mississippi, so that it pollutes the river at Davenport, because Davenport is engaged in the same practice to the detriment of Muscatine, Burlington and other cities south of her on the river. So Omaha and Council Bluffs have no complaint against Sioux City and Yankton, for the same reason that Kansas City cannot complain of Omaha.

The appalling part about the business is that the cities which empty their sewage below the corporation limits take their water for drinking purposes out of the same river above the city. Their drinking water may not be polluted by their own sewage, but it is by the sewage of the cities above. This, however, is true, if it shall be found, scientifically, that the sewage does pollute the water after a certain aeration has been accomplished.

He predicts that cities will eventually be compelled to keep their sewage out of rivers by federal statutes, in order to protect the drinking water of cities. His solution of the problem would be the establishment of filtration plants. For Davenport, a typical city of 40,000, which disposes of its sewage by sewers entering the Mississippi, and her garbage by dumping it by boat into the current of the river, he would buy 120 acres accessible and at a reasonable price. In 60 acres he would establish eight filter beds of seven and one-half acres each. This would enable each bed to work one day and rest seven. The plant would filter and dispose of the sewage of a city of 60,000 people indefinitely. The effluent from the beds would be almost pure water—purer, in his opinion, than the water now used out of the river for domestic purposes. The other 80 acres of the farm he would irrigate with the rich sewage and use for truck gardening. In this connection he refers to the Berlin farms of this character, which support by their revenues all the branches of the sewage disposal plant.

Contract to Restrict Competition Sustained in Iowa Supreme Court.

Judge Sherwin of the Iowa Supreme court has rendered a decision sustaining a contract entered into by the Des Moines Brick Paving Company with the Marshalltown Stone Company in consideration of keeping out of the Des Moines paving field. The case was tried by Judge Conrad of the Polk county district court, who sustained a demurrer filed by the Des Moines Brick Manufacturing Company, to the effect that the contract was not ratified and was against public policy. Judge Sherwin reverses this opinion and sustains the contract. The petition in the original suit alleged that the plaintiff was about to enter into a contract to furnish crushed rock for use in paving a certain street in Des Moines, when the defendant, the Des Moines Brick Manufacturing Company, stepped in and agreed to pay the Marshalltown company 25 cents per cu. yd. for the crushed rock used in paving said street, on condition that the plaintiff

would not enter into the contemplated contract nor sell any crushed rock in the city of Des Moines during the remainder of the year 1898; that plaintiff lived up to the terms of its agreement, and hence desired to recover the price promised by the Des Moines company if it would keep out of the Des Moines field. The Des Moines company filed a demurrer assailing the petition for want of consideration, and on the grounds that the agreement was against public policy and void because tending to prevent competition.

Judge Sherwin in reversing Judge Conrad's opinion, states that this agreement was valid and not contrary to public policy; that there was nothing in it which in the least indicated an intention to oppress or create a monopoly, as there might have been a large number of others as anxious and willing to supply the demand for crushed rock in Des Moines. Also, that because the sale of stone in Des Moines would have been of benefit to the plaintiff, it suffered a loss by entering into the contract with the Des Moines company, and any detriment of this kind is sufficient consideration for the other's promise.

Experiments on High Speed Electric Transportation.

The State Department has received a report from Consul-General Frank Mason, at Berlin, upon the high speed tests of electric cars which are to take place on the military line between Berlin and Zossen this fall. Mr. Mason says that as the time approaches both popular and scientific attention become more closely centered upon these experiments, the result of which will have such an important meaning, not only for Germany, but for all civilized countries, and among these, probably first of all, the United States. He says:

If an electric motor car, taking its current from overhead wires and running upon an ordinary standard gauge railway track, can carry with safety fifty or sixty passengers at a speed of from 80 to 150 miles an hour, then it is evident that the first ten years of the twentieth century will see the means of travel between populous cities and districts in America as in Europe, practically revolutionized.

The success of the electric car in rounding curves of small radius, climbing and descending easily grades which entailed all but hopeless difficulties to horse cars, and in general adapting itself to all the exigencies and requirements of intramural and suburban traffic has led the nontechnical public, here as in America, to expect an easy and prompt solution of the high-speed problem. From the popular standpoint, all that seemed necessary was a straight, clear track, an adequate current of high potential turned into a car motor of sufficient power, and the result would be achieved. Only the experts have realized that a speed of even eighty miles an hour with a single car involves questions of air resistance, weight and form and balance of vehicle, electrical transmission at high voltage and conversion to lower potential at some point between the generator and motor, and a dozen other equally important points which are new and untried in actual practice, and which have to be approached with caution and experienced knowledge in order to avoid danger of accidents that would discredit the whole enterprise at its outset. As the association which is undertaking at its own expense this most important demonstration includes a number of the foremost electricians in Germany, every step in the process of preparation for the coming tests is watched with intense interest by the engineers of other countries, and passenger railway construction may be said to have paused to wait the result of these experiments.

The scene of all the experiments is a stretch 14.29 miles in length, from Marienfelde to Zossen, on the military railway line which runs southward from Berlin to the place last named. The line is of standard gauge, single tracked, level and nearly straight, there being but one slight curve —1,100 yards radius,—near the southern extremity. The rails are of steel, weigh about sixty-five pounds to the yard, and are laid on wooden ties. During the past summer the track has been carefully surfaced, defective joints remedied and ties and ballasting put into perfect condition. Along this line have been set at intervals of 100 feet stout poles twenty feet in height, at the top of each of which is set in a vertical position and fastened by bolts, a bow or arch of angle iron ten feet in length, the chord of which supports the three brackets for insulators from which the three lines of conductors are hung. The conductors are ordinary copper wires about three-eighths of an inch in thickness, so hung that the trolley can make full contact from beneath.

"These will carry a three-phase alternating current of 10,000 to 12,000 volts, to be generated at Oberschonweide, on the River Spree, about five miles northeast from Marienfelde, between which two points a special overhead line for transmission has been provided. One of the conditions of the problem is that this high voltage, so essential for effective transmission, shall be reduced to a safe and practicable pressure by transformers carried in the motor car itself. The measure of speed to be attempted is 124 to 136 miles, approximately per hour, and the electrical apparatus must be sufficiently strong and heavy so that a run of 155 miles can be made at extreme speed without danger of overheating.

For this purpose two third-class passenger cars of the standard type used on the Prussian state railways have been built by Messrs. Van der Zuypen and Charlier at Cologne, and turned over to Messrs. Siemens & Halske and the General Electrical Company of Berlin, respectively, each of whom have furnished the electrical equipments of one car according to their own ideas. There will be therefore two competitive machines, each representing

the highest scientific skill of two leading electrical manufacturers of Germany.

The cars are 72.18 feet in length and weigh 90.5 metric tons, of which forty-eight tons comprise the body and running gear (viz., two six-wheeled spindle trucks of the American type) and 42.5 tons are made up by the motors, transformers and other details for the electrical equipment. Each car is designed to accommodate fifty passengers, who with the driver and conductor will add about four tons to the aggregate weight of the carriage. The motors are four in number, with an aggregate energy of 1,000 horse-power, and are attached to the front and rear axles of each truck, the middle pair of wheels in each group of three running free. In the car equipped by Messrs. Siemens & Halske the motors weigh 8,984 pounds, the transformers—which weigh twelve tons—are hung centrally beneath the floor, and a storage battery of 631 pounds weight supplies current for lighting purposes. The ends of the car are pointed to minimize wind resistance, and it runs, of course, in either direction. The wheels are forty-nine inches in diameter, and are rigged with pneumatic brakes of the Westinghouse type. It is expected that the current will be reduced by the transformers carried under the floor of the car from the initial voltage of 10,000 or 11,000 to a potential ranging from 1,500 to 1,800 volts, which it is assumed will be sufficient to attain the proposed speed, without danger to machinery or operatives.

Track Depression Proposed in Summit, N. J.

Plans for track depression in Summit, N. J., have been submitted to the city officials by Engineer MacFarlan, of the Lackawanna railroad. The plans provide for depressing the tracks from a point one-half mile east of the Summit station to the city limits, a total of almost two miles, and the depression varying from five to twenty feet. The depression of the tracks would result in abolishing five grade crossings in the city and leaving but one. The engineer estimates the cost of the work as far as High-st. at $422,140, and for the improvements beyond that point at $104,000. He declares, however, that the latter are of no material benefit to the city.

Track Elevation Proposed for Evanston, Ill.

Track elevation is favored in the report of Lyman E. Cooley, who was engaged by the city of Evanston, Ill., to report on the abolition of grade crossings. He gives as practical objections to track depression the following:

1. The cost is excessive.
2. The maintenance is increased; viaducts deteriorate rapidly from corrosive gases.
3. The removal of snow is more difficult, and storms are more likely to interrupt traffic.
4. Track depression interferes with operation more seriously than elevation.
5. Track depression does not correspond to the policy adopted elsewhere for the improvement of the property.
6. The railways demand a head room of 22 feet, or 6 feet more than hereinbefore assumed as necessary, thus requiring a viaduct approach over 550 feet on certain streets herein noted. This headroom is stated as necessary for freight traffic, the line being used at night for through freight and for local switching.

He says that track elevation is the most practicable plan of doing away with grade crossings in Evanston, and that the objectionable features as they exist may be materially mitigated.

More Track Elevation in Chicago.

The track elevation committee of Chicago agreed upon ordinances, Oct. 17, for the elevation of the Chicago & Northwestern, the Chicago, Milwaukee & St. Paul and the Belt railroad. The lineal elevation is 4 mis., and the mileage of tracks is 25.81. The cost will exceed $1,000,000 and the work is to be completed on or before Dec. 3, 1906.

Cost of Electric Light in Crawfordsville, Ind.

The city of Crawfordsville, Ind., has owned its electric light plant for about eleven years, and the discussion of its expense has been almost constant. The Crawfordsville Journal computes the average cost for the whole period of operation by subtracting the total receipts ($76,722.24) from the total expenditures ($239,429.65), then subtracting the estimated present value of the plant, dividing this sum by the number of years (10 years 5 months) and the average number of lights per year (143). If the value of the plant is assumed as $40,000, the average cost per lamp per year is $82.37; if it is assumed as $50,000, the average cost is $75.66. Under an arrangement entered into with the present superintendent about a year ago, making allowance for free light furnished, the arc lamps cost an average of $60.61 a year, but, while $1,000 is charged as part of improvements made, there does not seem to be sufficient account taken of interest on investment and deterioration. In no case is there any information given regarding interest, and it is quite probable that this item has been neglected throughout. If the figures given are assumed to include everything, it may be said that the maximum figure, $82.37, corresponds quite closely with the maximum cost for 4,000-hour service in municipal plants given on page 157 of Municipal Engineering for September, and is $33.44 less than the average paid to private lighting plants. The smaller figure, $75.66, is $4.50 more than the average cost in municipal plants, and $40.15 less than the average price paid private companies for public lighting. Crawfordsville was then as well off as other cities

of similar size operating their own plants, and much better off than those buying light of lighting companies. Under the new arrangement, under which the cost is computed at $60.61 a year, the cost is $10.55 less than the average cost of city plants and $2.79 less than the minimum price paid to lighting companies. At present, therefore, Crawfordsville seems to be much more favorably situated than other cities of its size.

Improvements in Terre Haute (Ind.) Water Works.

The Terre Haute Water Works Company is constructing a settling basin 230 feet long and 66 feet wide, with a division wall through the center. The outside walls are seven feet in hight, four feet thick at the base and two feet thick at the top. The division wall will be six feet thick at the base and three feet thick at the top. The walls will be made of Atlas Portland cement concrete in the proportions of one part cement, three parts sand and gravel and four parts of stone crushed to pass a one and a half-inch mesh. The bottom will be made of two six-inch courses of Portland cement concrete. Machines will be used for mixing the concrete. The basin will provide a sedimentation area during flood stages of the river sufficient to allow three or four hours' subsidence. When not needed for sedimentation purposes the basin can be used as a clear water reservoir for the effluent from the filters. Dow R. Gwinn is the president and manager of the company and has the work in charge.

Indiana Cement Industry.

Indiana has long been one of the foremost producers of natural hydraulic cement and now bids fair to take a high position in the ranks of Portland cement producers.

The Portland Cement Company, at Portland, in 1899 erected a $500,000 plant, doubling its capacity. The mill, when finished, will represent an outlay of $1,000,000. Its daily capacity will be 1,500 barrels of cement.

At Stroh, Lagrange county, the Wabash Portland Cement Company is arranging to double its capacity. Last year it completed its plant, which cost $500,000. Six hundred barrels of cement are manufactured daily by this company.

A plant to cost $500,000 is being built at Bristol in St. Joseph county. A dam to cost $40,000 is being built across St. Joseph river. Water power will be used to produce electricity, the motive power.

A plant will be put up at Milford, Kosciusko county. Goshen parties have purchased marl lands costing $11,600. This land is the beds of Mud and Colley lakes. Here a $500,000 plant will be built. At Mitchell and Milltown $500,000 Portland cement mills are being built. These mills propose to use oolitic limestone, instead of marl. This stone contains a large percentage of purest carbonate of lime, but the cost of handling will be greater than marl, owing to the necessity of reducing the stone to fine powder.

It is predicted that by 1903 Indiana will have five big modern plants in operation producing 4,000 barrels of Portland cement daily, or 1,400,000 yearly.

There are thirty-two deposits of Portland cement materials in the counties of Kosciusko, Steuben, St. Joseph, Noble and Elkhart. Each one of them is capable of running one plant of 500 barrels or more a day for thirty years. There are deposits that will run five-thousand-barrel mills a century, it is said.

Technical Meetings.

The sixteenth annual convention of the N. B. M. A. will be held at Cleveland, O., Feb. 10 to 15, 1902.

The annual convention of the American Society of Mechanical Engineers will be held in New York City Dec. 3 to 6. F. H. Hutton, sec'y., N. Y. City.

The annual convention of the American Street Railway Association was held at Madison Square Garden, New York City, Oct. 9 to 11. Papers were presented as follows:

"Street Railways: A Review of the Past and a Forecast of the Future." By Robert McCulloch, General Manager, Chicago City Railway Company, Chicago, Ill.

"The Adoption of Electric Signals on Suburban and Interurban Railways, Single or Double Track, and Their Economy of Operation." By William Pestell, Superintendent of Motive Power, Worcester Consolidated street Railway Company, Worcester, Mass.

"The Value of Storage Batteries as Auxiliaries to Power Plants." By W. E. Harrington, Vice-President and General Manager, Camden & Suburban Railway Company, Boston, Mass.

"The Best Method of Conducting the Return Circuit to the Power House." By E. G. Connette, Vice-President and General Manager, Syracuse Rapid Transit Railway Company, Syracuse, N. Y.

"The American Street Railway Association: The Purpose of Its Organization and the Benefits Accruing to Investors in and Operators of Street Railway Properties by Membership Therein.' By G. W. Baumhoff, St. Louis, Mo.

"The Economies Resulting from the Use of Four Motors Instead of Two on Double Motor Equipments."

"The Best Form of Car for City Service: A Consideration of the Various Types of Car as to Size of Car and Arrangement of Seats, Including Best Types of Brakes and Wheels." By Eugene Chamberlain, Superin-

tendent of Equipment, Brooklyn Rapid Transit Company, Brooklyn, N. Y.

"Practical Results Obtained from Three-Phase Transmission and Rotary Transformers or Motor Generators in Transmitting Power on Railway Lines."

"Relations of Interurban and City Railways." By Ira A. McCormack, General Manager Cleveland Electric Railway Company, Cleveland, O.

"The Modern Power House, Including the Use of Cooling Towers for Condensing Purposes." By J. H. Vail, Philadelphia.

"Alternating and Direct Current Distribution." By M. S. Hopkins, General Manager Columbus Railway Company, Columbus, O.

Some of these papers will appear in later numbers of Municipal Engineering.

Officers for the ensuing year were elected as follows: President, H. H. Vreeland, New York City; vice-presidents, C. W. Wason of Cleveland, E. C. Foster of Boston, H. M. Sloan of Chicago; secretary and treasurer, T. C. Penington of Chicago.

The first annual meeting of the League of Tennessee Municipalities was held in Nashville, Tenn., Oct. 9. The question of municipal water works was discussed by Mayors W. A. Foulkes of Dyersburg, J. W. Blackmore of Gallatin, E. E. Erwin, representing Mayor J. D. Cameron of Columbia, and W. A. Kleeman, representing Mayor Young of Clarksville. The report of Mayor Cameron, chairman of the committeee on assessments and taxations of thirty-four cities in Tennessee, was read by Mr. Erwin. R. T. Spraggins, city attorney of Jackson, read a paper on the subject of franchises, in which he made many valuable suggestions. The president of the committee on municipal bookkeeping was authorized to appoint a committee to prepare a system of uniform bookkeeping for municipalities to be submitted at the next meeting of the league.

Officers were elected as follows: President, Mayor Head of Nashville; vice-presidents, Mayor A. W. Chambliss of Chattanooga, Mayor W. A. Foulkes of Dyersburg and Mayor J. D. Cameron of Columbia; secretary and treasurer, Mayor James W. Blackmore of Gallatin.

The next meeting will be held in Nashville the second Wednesday of October, 1902.

The League of Iowa Municipalities held a convention in Oskaloosa Oct. 9 and 10. The committee on city government and legislation recommended changes in the state laws governing the methods of paying assessments for public improvements and cost of infectious disease treatment.

A conference of sanitary officers of the state of New York, held at Albany, Oct. 24 and 25, discussed a number of subjects of which those most interesting to our readers are the milk supply of cities and villages, and sewage disposal for cities and villages. The meeting was held under the auspices of the State Board of Health and is a good model for other states to follow.

The Connecticut Valley Highway Association held a very interesting meeting at Westfield Oct. 9. Addresses were made by President W. L. Dickinson, Senator H. S. Earle of Detroit, Henry W. Ely of Westfield, W. E. McClintock of the Massachusetts Commission, Henry Manley of the engineer department of Boston, F. A. Dunham of New Jersey. Such conferences as this are of great value in developing a public sentiment in favor of the best highways.

Convention of Central States Water Works Association.

The fifth annual convention of the Central States Water Works Association was held at Evansville, Ind., Oct. 1 to 3. Electrolysis was the subject of two papers presented by Edwin P. Matthews, city solicitor of Dayton, O., and L. S. Anderson, electrical engineer of Franklin, O. Mr. Matthews stated that the city of Dayton owned its own water plant and had begun legal proceeedings to obtain redress and to put an end of the menace to its property.

Suits have been instituted against the street railroad companies both to recover damages for injury already done the pipes and to obtain decrees compelling the companies to inaugurate systems of traction which will prevent injuries to the pipes from electrolytic action. We think we shall succeed in both classes of cases.

The law authorizes the use of the streets and public ways for water and gas pipes as well as for street railroads. Municipalities and companies owning gas and water works, and street railroad companies can so conduct their respective businesses and operations as not to interfere with each other, and we believe the law will force them to do so. If water pipes were permitted to leak so that the roadbed of a street railroad was being ruined, and against which damage the street railway company could not proteect itself, surely the law would make the municipality or company owning the pipes remedy the evil. Likewise, it occurs to me, that as cities and companies cannot protect their gas and water pipes from electrolysis caused by street railroad companies, which companies can so operate their roads as to avoid the damage by adopting well known systems and devices, which it is reasonable to ask them to adopt, that the law will compel them to do so and will hold them responsible for damages arising from wantonly discharging electricity into the earth, regardless of the rights of others.

Mr. Anderson stated that the Southern Ohio Traction Company operates a single trolley line from Dayton, O., to College Hill, a suburb of Cincinnati, and uses four power houses, one of which is located in Franklin, O. The road was put in operation through Franklin July 1, 1897. Within a few

months after that time service pipes belonging to the village water works system, and located in the streets along which the electric railroad runs, began to burst from the electrolytic action of the return currents of the railroad. From the beginning of the operation of the road until Aug. 22, 1900, out of 127 service pipes located in these streets, 35 had to be replaced once, 7 twice, and 1 three times. Electrical examinations were made in 1898, 1899 and 1900 on the water system, all of which showed the electrical conditions to be quite serious. In July, 1900, an examination of the cast-iron mains located in these streets was made by excavating and exposing the pipe for a length of about 10 ft. every 500 ft. This examination of the mains showed that they had almost entirely lost their tar coating, and that they were corroded and pitted at each of the stations, some of the pits on the pipes in front of the railroad company's power house extending into the pipe for a distance of at least three-fourths of the thickness of the shell of the pipe.

As a result of these examinations, both electrical and physical, and the continuing loss of the service pipes, an action for $10,000 damages was brought against the railroad company and heard last March in the Warren County Common Pleas Court. When the case got to the jury they decided unanimously that the allegations of damage and the cause of the damage had been proven, but failed to agree to a verdict and were discharged by the court.

The cause of the failure to agree, it was afterwards learned, was owing to that part of the court's charge pertaining to contributory negligence.

The report of the committee on electrolysis has been completed and will be included in the published proceedings of the convention. The committee, of which F. A. W. Davis of Indianapolis, is chairman, was continued for another year.

In a paper on "The Driven Well Water Supply of Dayton, O.," Chas. E. Rowe, secretary of water works trustees, Dayton, said:

All new wells are of 8-in. galvanized iron pipe, with a Cook brass strainer 8 to 10 ft. long at the bottom. Each well is cut off at the proper elevation with the suction pipe, and a T casting fitted on the top. The top branch of the T is threaded for taking the plugs and a 9-in. wrought-iron pipe casing, both of which extend to the surface of the ground. By this means a well may be gotten into without excavating. The horizontal branch of the T leads to the suction pipe. Before reaching the suction pipe, a valve is set in the branch in order to shut off each well independently.

The suction mains necessary to carry the water from the wells to the pumping station are as follows: In the rear of the pumping station is a 66-in. suction main, or header, 300 ft. long, extending from near Ottawa-st. to the north side of the river; a 30-in. pipe some 612 ft. long leads down to the river, at the end of which it reduces to 48 ft. of 24-in. pipe and 48 ft. of 20-in. On this main are 22 wells, eight of which are new ones, placed there last season. These 22 wells, under test in the dry season, gave a rate of 7,500,000 gallons of water in 24 hours.

The other branch is a 60-in. pipe going up the river 1,900 ft., and having 56 wells connected to it. At the end of this 60-in. pipe there will be a 30-in. "Y" branch leading to the left or north and having 15 wells connected to it. The end of this 60-in. pipe will be plugged, so that at some later day, should more water be required, it may be extended without crippling the system. These 71 wells are figured to give 28,500,000 gallons of water in 24 hours, which will make a grand total of 36,000,000 gallons in 24 hours from the 93 8-in. wells.

Twelve hundred feet from where the 60-in. main branches off from the 66-in. pipe, there is a 30-in. "Y." From this "Y" a 30-in. suction main is carried back to the pump house on the south side of the levee. This 30-in. suction has no wells connected to it at present, and will be used for carrying the water to the station in lieu of the 66-in. should it become necessary to make any repairs in the line. The suction lines leading up and down the river from the 60-in. suction header have a fall of 1 in. to 100 ft. either way from it; and the well connections are laid to a grade of 6 ins. in 100 ft. This is done in order to avoid air pockets forming in the pipes, which would obstruct the flow, and to allow the air to arise readily and easily to the vacuum pumps in the station, where it is removed, which prevents it from entering the large pumping engines.

Although the 5-ft. suction pipe running up the river weighed about 1,000 lbs. per lin. ft., the engineering and laying was so carefully carried out that the water from the wells near the suction header flowed to the extreme east end of this main without leaving any pockets of water in the pipe to exceed ½-in.

Inasmuch as Dayton is probably the largest city in the United States obtaining its supply by means of the tube well system, frequent inquiries are made of us as to our method of cleaning the wells from sand. We do this in the following manner: First, water is forced into the well by a steam fire engine, which thoroughly loosens all the material adjacent to the well; then a horizontal centrifugal pump is directly connected and the well given a heavy pumping. During this pumping the column of water is dropped at intervals to keep all loose particles of sand in agitation. After a length of time the water becomes clear and free from all sand.

By actual test, a well that gave only 142 gallons per min. at the start, delivered 436 gallons per min. at the end of twelve hours continual pumping. We measured the discharge of each well by means of a weir box and hence have records for each well.

John Langan, superintendent of water works at Tipton, Ind., presented a paper on "Lifting Water With Compressed Air at Tipton, Ind.," in which he stated that the city secures its water supply from ten wells, 55 to 500 ft. in depth. Of these wells

two are 4 ins., six are 6 ins., and two are 8 ins. in diameter. Water was found at depths of 55 and at 106 to 110 ft., which, when tapped, rose to within 7 or 8 ft. of the surface. When connected to two pumps they yielded only 180,000 gallons of water a day. Early in 1900 Mr. Langan was authorized to develop more water. He arranged with the Ingersoll Sergeant Drill Co., of New York, for a test of the wells, subsequent developments of which were as follows:

The compressor was connected to two wells, one 6-in. well and one 8-in., and started May 1, 1900. The first test showed the 6-in. well to be yielding 40 gallons per min., and the 8-in. well 70 gallons per min. After working the wells for 24 hours and making some minor changes in the air lines, the 6-in. well yielded 60 gallons and the 8-in. well 90 gallons per min., and on the fourth day the 6-in. well produced 75 gallons per min., and 8-in. well 130 gallons per min. Other wells were tested with results proportionately to the first, and at the end of 30 days' test the results were so satisfactory that I was instructed to purchase a compressor suitable for our service.

A class G duplex compressor, 10x12¼ ins., was purchased and installed the first week in December, 1900. The service rendered is very gratifying. We have had no trouble in supplying all demands that have been made on the plant, working the air lift on two wells with what assistance was given by the suction pumps. At any time in the future other wells can be connected up with the air with very little expense, and add very materially to the supply; for the test has already been made and the results are known.

The compressor is run at 32 revs. per min., carrying 33 lbs. air working pressure on a lift of 40 ft.

The Tipton plant is in the center of a group of water-works plants, that are successfully operating the air-lift system, Alexandria and Elwood on the east, Noblesville and Indianapolis on the south, Frankfort on the west, Peru and Marion on the north, and Bluffton on the northwest.

A paper on "Hot Water Heating from a Central Station" was read by C. W. Wiles, superintendent of water works at Delaware, O. He said that the Delaware Electric Light, Heat and Power Company of that city has operated a hot water plant for four years. Although the temperature had been as low as 29 degrees below zero since the plant was put in, satisfactory results had been obtained.

Other papers presented were: "Pure, Wholesome Water, How Obtained," Cleophas Monjeau, Middletown, O.; "The Causes of Tastes and Odors in City Waters," S. J. Hoggson, New Haven, Conn.

Joseph J. Pater, Hamilton, O., was elected president. Wm. A. Veach of Newark, O., secretary, and Charles E. Rowe of Dayton, treasurer, for the ensuing year. The next convention will be held at Indianapolis.

New Publications.

Report of Board of Engineer Officers on Testing Hydraulic Cements, with specifications for the several classes used by the Engineer Department. Professional Papers of the Corps of Engineers, United States Army, No. 28, 38 pp. Cloth. Headquarters, Corps of Engineers, Washington, D. C.

This report is prepared by Major William L. Marshall, Major Smith S. Leach and Captain Spencer Cosby of the Corps of Engineers, United States Army, members of the board appointed for the purpose. The values of tests for fineness of grinding, for specific gravity, for activity, for constancy of volume and for strength, and the value of accelerated tests are discussed briefly and clearly. The board recommends all these except the last, and also the determination of time of setting, permitting accelerated tests simply as suggestive or discriminative not as final under usual conditions. The offer of a bonus for high test is condemned. Full directions for manipulation of cement for tests are given, for detailed examination, and for tests on the work. The tests are also classified as purchase and acceptance tests. Particular attention is paid to silica and slag cements. Specifications for American Portland and natural cements and puzzolan are presented as the standards for different classes of work under the supervision of the Engineer Department. The report is a very valuable contribution to the literature upon the practical selection and use of cement on account of its clear and concise statement of the requirements for the best practice.

Financial Annual of Japan. No. 1, Issued by the Department of Finance, and distributed by the Philadelphia Commercial Museum, 233 S. Fourth-st., Philadelphia, Pa.

The seventy-four pages of tables in this publication show the comparative statistics for a number of years, in some cases since 1870, of Japan, giving for each year statements of receipts and expenditures, national debt, local loans, issue of bonds of companies, capital of same, bank statistics, money in circulation, rates of interest, values of various commodities, amount of commerce, statistics of railways, ports, telegraph, savings deposits, wages, population. The rapid growth of the empire is graphically shown and will prove interesting notwithstanding that it is given in the dryest possible form of statement, that of statistical tables without comment.

"America Today," by an Englishman; 20 pp. paper. The League of Associated Engineers, New York, N. Y.

This is an article reprinted from the London Daily Telegraph, and discusses in a free and frank manner from the English point of view the industrial and commercial

development of the United States and its dangers to the supremacy of the British empire in these regards. It is very interesting as a revelation of the high position this country is taking in the world, and of the effect which its development is beginning to have upon other countries.

"The Source of Milk Supply for Towns and Cities," by A. W. Betting, M. D. Bulletin No. 8, Indiana Agricultural Experiment Station, Lafayette, Ind. 69 pp. paper.

This paper considers the important question of the city's milk supply in detail, including in the discussion some statements regarding the proper qualities of the herd, its food, water, and stable, the methods of milking, and cooling and delivering the milk, with some sample descriptions of dairies and reports of inspections. It will be of much interest to city officials, especially those having the sanitary interests in charge, and is a valuable guide to the sanitary officers of the smaller cities in this greatly neglected branch of their duties.

Report of the National Municipal League Committee on Uniform Municipal Accounting and Statistics. Dr. Edward M. Hartwell, Chairman. 18 pp., paper. National Municipal League, Philadelphia.

In addition to the report of the committee at the Rochester meeting of the league the pamphlet contains a report of the conference on uniform municipal accounts of representatives of committees of various societies, a list of the names of members of such committees and Schedule D for uniform reports of municipal receipts and expenditures as recommended by the committee.

The Improvement of Towns and Cities, or the Practical Basis of Civic Aesthetics. By Charles Mulford Robinson, Member of the Architectural League of America's National Committee on Municipal Improvements. 309 pp. Cloth, $1.25 net. G. P. Putnam's Sons, New York and London.

Although this book has been issued but three or four months a second edition is already in preparation, an indication that it is doing a needed work in a satisfactory manner. It certainly discusses the questions of municipal beauty and the methods of answering them in a manner which is highly imaginative and artistic and at the same time thoroughly practical. Its statements of results that have been obtained and the methods used are directly applicable to the solution of similar problems in other cities and show the practicability of the propositions for improvement in other directions. The titles of chapters are sufficient to show the value of the books to all public-spirited citizens, who are interested in preserving and increasing the beauty of their surroundings, and its practical value to the official of municipality or improvement society having the duty of preparation of such plans and oversight of their application is all that is necessary to emphasize in this notice.

The foundations of civic beauty are discussed in chapters on the site of the city, its street plan and such elementary constructions as bridges, street paving, including cleaning and lighting. Beauty in the street is shown to depend upon suppression of such nuisances as wires and smoke, the repression of street noises and the like, the regulation of buildings, advertisements, architecture, trees and street gardens, the possibilities in America in each of these directions being fully discussed. The aesthetic phase of social and philanthropic effort is exemplified in chapters on parks, drives, squares, play grounds and architectural development and obligations. The aesthetic phase of educational effort is shown in the discussions of the function and placing of sculpture and methods of art education in schools and galleries. The means to secure civic aesthetics are shown to be in the work of individuals and societies, the workings of some of which are described, and in the work of officials, the advantages of art commissions and co-operation of municipal officials being set forth clearly and distinctly.

Statistics of Cities. Bulletin No. 36 of the Department of Labor. Carroll D. Wright, Commissioner, Washington, D. C. September, 1901. 214 pp., paper.

This is the annual publication upon statistics of cities issued by the Department of Labor and gives twenty-three tables of statistics from the 135 cities in the United States having 30,000 population or more. Date of incorporation, population, area, date of ending of fiscal year, police and fire statistics, vital statistics, areas of parks, mileage of streets, sewers, street railways, street cleaning, garbage disposal and other sanitary questions, street lighting, municipal water, gas and light plants, school and libraries, charities, debt and legal limit, basis of assessment valuation and tax, receipts and expenditures, assets, per capita averages of many of these items are reduced to figures in these tables. The value of this publication is great and is a standing argument in favor of concentrating all the statistical collections of similar nature in a permanent office under constant expert control.

Twenty-first Annual Report of the United States Geological Survey, Charles D. Walcott, Director. Part VI, Mineral Resources of the United States, 1899, in two volumes.

The first volume of this section of the Geological Survey report contains a report of the metallic mineral industries for 1899 and of coal and coke, and the second volume of the other non-metallic mineral industries, about half of this volume being devoted to petroleum. Some extracts from the reports on asphalt and cement are given on another page. Each special report is

made by an expert in the trade and is of great value in giving an idea of its extent and growth. Only in so rapidly growing an industry as Portland cement is the delay of a year and a half or more in printing the report enough to make it seem seriously behind, and this is undoubtedly a temporary phase.

Bricklaying. By Owen B. Maginnis. 85 pp. Cloth, $2. Published by the author, 310 W. 128th-st., New York.

This is a practical book giving the results of successful experience. The first chapter gives illustrations and descriptions of bricklayers' tools and the methods of using them. The second chapter discusses methods of laying out work, the third the mixture of concretes and mortars, the fourth to ninth chapters the methods of bonding walls, biulding corners and intersecting walls, fronts, arches, piers, lintels, chimneys, flues; the tenth many miscellaneous details of importance. A second part describes shoring, needling, underpinning and sheet piling. The book is fully illustrated throughout and will be of great value to the architect, engineer and inspector, as well as to the bricklayer who is desirous of knowing his trade thoroughly.

What Is a Kindergarten? by Geo. Hansen, Landscape Architect, Berkeley, Calif. 76 pp., cloth. 75 cents.

This is the first part of a series of booklets on park and pavement, and considers the development of interest in plants and trees among children. It describes a number of them, the methods of their growth and their treatment in yard, garden and street. A number of plates show methods of laying out Kindergartens under various assumed conditions, and planting schemes are supplied for each plate. The book is a clear exposition of the delights of such a method of imparting instruction, and is at the same time a most excellent instructor in the art of planting and taking care of plants, shrubs, grass and trees on a city lot or lawn.

A, B, C of the Telephone; a practical and useful treatise for students and workers in telephony, giving a review of the development of the industry to the present date and full descriptions of numerous valuable inventions and appliances, together with very many illustrations, diagrams and tables. By James E. Homans, A. M. 332 pp. cloth, $1. Theo. Audel & Co., 63 Fifth-ave., New York.

The description quoted above from the title page gives a general idea of the contents of the book. It is an elementary treatise, opening with a chapter describing the telephone apparatus, followed by chapters on the theory of sound and the principles of electricity and the definitions of electrical terms. A history of the development of the telephone introduces detailed descriptions of the various forms of the many parts of the 'phone, the transmitting apparatus, switchboards, batteries and methods of use of lines and signals. Private lines, large and small, are described, and automatic exchanges. Wire and cable lines, aerial and underground, are described, with methods of putting up poles and lines, protecting apparatus from electrical disturbances, balancing circuits, etc. Useful definitions and information are collected in a couple of chapters at the end. To one not an expert in telephony the book will be found interesting and instructive and it will doubtless be of assistance to any one desiring a book for reference regarding ordinary telephone practice.

Elevation and Stadia Tables, for obtaining differences of altitude for all angles and distances, horizontal distances in stadia work, etc., with all necessary corrections, together with hydraulic tables giving velocities for various channels and slopes. By Arthur P. Davis, M. Am. Soc. C. E., Hydrographer, U. S. Geological Survey. 43 pp. Cloth $1. New York: John Wiley & Sons.

The first table gives the differences in altitude for each minute of vertical angle from 0 to 15 degrees and for distances in miles from 1 to 9, with corrections for curvature, refraction and height of instrument. A second table gives the differences for angles from 15 to 26 degrees for distance of one mile, and another for each 2 minutes from 0 to 8 degrees for distances of 100 to 900, the difference in elevation being in the same measure as the distances, i. e., feet, meters, etc. This table also gives the horizontal distances and is continued for each 5 minutes of arc from 8 to 20 dedegrees and for distances of 100 from 20 to 40 degrees. Other tables give corrections for curvature, refraction and focal length. Tables of velocity of water in channels of special description according to Kutter's formula are also given, such as those lined with planed timber, cement and sand mortar, brick, earth or gravel, etc., etc., values of in in the formula varying from 0.01 to 0.035.

The book is evidently prepared for the special work of the Geological Survey, but will be found to have considerable value for all persons engaged in topographic or irrigation work.

Proceedings of the Minnesota Surveyors' and Engineers' Society at its fourth, fifth and sixth annual conventions. 116 pp. paper, 50 cents. Charles A. Forbes, secretary, 11 Court block, St. Paul, Minn.

There are three presidents' addresses, a number of papers on surveyor's office and field work, on bridges, road laws and road maintenance, on drainage and maintenance of ditches, on the building stones of Winona and an interesting study of the inflow and outflow of Lake Minnetonka, giving some valuable data on the important ques-

tion of the proportion of the rainfall reaching the natural drainage channels.

Transactions of the American Ceramic Society, containing the papers and discussions of the third annual meeting held at Old Point Comfort, Va., Feb. 11-13, 1901. 230 pp., paper, Edward Orton, jr., secretary, Columbus, O.

This new and vigorous society has discussed a number of questions of importance in the manipulation of clay and the manufacture of wares from it, and the papers and discussions in this volume show the value of its meetings to the clay industries, more especially in the higher grades of work. Two papers in this volume will be of interest to engineers, particularly those engaged in cement manufacture or use, one on testing of clays for cement manufacture and one on continuous kilns.

N'caragua or Panama as the route for the isthmian canal is discussed in a pamphlet by Philippe Bunau-Varilla, former engineer-in-chief of the Panama canal, purporting to give the substance of a series of conferences with the Commercial club and the Engineers' club of Cincinnati, the Commercial club of Boston, the National business league in Chicago and addresses at Princeton university and before the Chamber of commerce of the state of New York. The advantages of the Panama route and the disadvantages of the Nicaragua route are set forth and made emphatic by graphical diagrams showing to the eye the differences described.

The Engineers' club of Philadelphia issues a very convenient little directory of its membership, giving name, occupation, address and date of membership. It also gives the standing committees, charter and by-laws. The society is in a flourishing condition, having 451 members July 1, an increase of ten members in six months.

A chart giving the principles of the metric system and English equivalents is issued by Bigger, Samuel & Co., publishers of the Canadian Engineer, Toronto, and sold for 10 cents. The January number of the magazine was reproduced completely in miniature.

The argument of Ernest C. Koutz, councilman in the general council of the city of Atlanta, Ga., favoring the grant of a franchise to the Atlanta Rapid Transit company for 21 years with an equitable payment per annum to the city, speaking against a motion to grant a franchise without these conditions over the veto of the mayor, has been printed for distribution and will prove interesting to city officials considering the franchise question.

The current issue of Municipal Affairs, published by the New York Reform Club, 52 William street, contains a most unique and valuable contribution on the street railway problem. It consists of an examination of the books of account and corporation records of the street railway companies of Chicago, made for the Civic Federation of that city. No similar work for any American city has ever been published, and the facts brought to light by the expert accountant, Mr. Edmund F. Bard, are astounding and invaluable. For the first time we have the inside facts of street railway management. An analysis of the financial operations has been prepared by Dr. Milo Roy Maltbie, who edits the Monograph. Other articles in this issue are: "Growth of Cities, 1890-1900," by Dr. Adna F. Weber; "Franchise Legislation in Illinois," by Hiram B. Loomis; "Valuation of City Real Estate for Taxation," by W. A. Somers; "Our Heritage of the Picturesque," by E. H. Hall; "Recent Franchise Legislation in Philadelphia," by Clinton Rogers Woodruff; "Boston's New Subway," by Willard Winslow; "New York's Subway Policy," by Justice William J. Gaynor.

Municipal Reports.

Report of the City Engineer to the Commissioner of Public Works relating to an Investigation of Electrolysis in the Water Pipe System of the City of Rochester, N. Y. By Edwin A. Fisher, City Engineer. 86 pp. and 10 plates, paper.

The report gives a description of the street railway system and a statement of the results of a careful investigation of the condition of the returns on all the lines, showing in general poor condition. Observed damage to water pipes is shown and probability of damage not yet discovered is shown by study of the skeleton map of railway and pipe lines and the statement of condition of returns. A large part of the report is devoted to a careful statement of the results of similar investigations in other cities, so that this is perhaps the best publication from which to derive information concerning electrolysis and its effects which has yet appeared.

City of Chicago Statistics. September, 1901.

The tables are continued for two more months. One appendix gives the city taxes collected from 1881 to 1900, separated into their proper classes, including those for corporate purposes, for judgments, interest, sinking funds, library, schools. A column shows the deficiencies from the amounts actually levied, and another column shows the total of all taxes levied in Cook county for each year. Another appendix gives the total receipts of the city from all sources for the same years, including the city's funds from taxes, licenses, department of public works, sewers, police, house of correction and building departments, rents, general fund and miscel-

laneous, the school funds from taxes and other sources, the water fund, and trust funds, including special assessments and deposits. In both tables the more important items are stated, both in total and per capita of population.

Report on the Sewerage, Drainage and Sewage Disposal for the City of Columbus, O., Oct. 30, 1900. By Julian Griggs, C. E., Engineer for the Sewer Commission, 144 pp., paper.

A Report to the President of the Sewer Commission and Director of Public Improvements on Sewerage and Sewage Disposal for the City of Columbus, O., May 6, 1901. By Rudolph Hering. Hydraulic and Sanitary Engineer. 34 pp. and 6 plates, paper.

Report made to Hon. L. B. Kaufman, Director of Public Improvements, on the Improved Water Supply of the City of Columbus, O., Feb. 2, 1901. By Samuel M. Gray, Consulting Engineer. 148 pp. and 2 plates, paper.

These reports are the basis upon which rested the propositions to raise $2,500,000 for municipal improvements submitted to the people in August and defeated by a decisive vote. Columbus is unfortunate in being forced to consider at the same time great changes in and additions to its sewerage system, the sewage disposal problem in a serious form, the development of a new water supply, additions to the water distribution system and a proposition to purchase and operate the electric light plant. Some of these propositions have been under consideration for several years, but for one reason or another have not been pressed to final decision until all demand immediate attention. The negative vote this summer simply delays the matter until another form of proposition can be prepared, for action on the sewage disposal and the new water supply in particular is imperatively demanded. It is not possible for one unfamiliar with the engineering features of the situation to conceive any possible practical solution of the water and sewer problems which is not considered in the reports named, and certainly the engineering skill which is evidenced by them is of the highest order. It is not necessary to give the details of the reports here further than a summary of the cost of construction. Mr. Griggs recommends for immediate construction 31 miles of sewers at an estimated cost of $729,781, and for future construction 29 miles at a cost of $671,157. Each sewer is estimated in detail for each street in the line, each size, giving average cut, length, price per foot and detailed cost of all appurtenances, repaving, engineering and inspection. A detailed table showing the excess of the possible drainage flow over the capacity of each present sewer, makes the necessity of the new sewers painfully evident. Sewage disposal with septic tanks is estimated to cost $356,457, with addition of sand filtration, $742,561, necessary pumping stations and force mains, $120,384; repairs to main trunk sewers, $34,025. The total for the portion immediately required is $1,240,647, including sand filtration, septic tank alone not being satisfactory to the state board of health, is $1,626,751, and for all the construction planned, $2,297,908. Mr. Hering estimates that the urgent sewers will cost $857,319, and the sewage disposal plant, $1,219,016, but proposes the present construction of only part of the latter, costing $586,566, leaving the rest until further study under actual operation of plant verifies the predictions regarding its efficiency.

Mr. Gray estimates the cost of the portion of the water works needed at once at $2,195,663, and the yearly cost of purification or purification and softening at $48,431 to $139,643 according to system used. The total first cost of new construction planned is approximately double the amount required for present use, varying according to detail of plan adopted.

Third Annual Report of the Board of Public Works, Geneva, N. Y. F. A. Malette, President; E. Seyboldt, Superintendent.

The board has charge of the streets, parks, water works and sewer system of the city. The benefit to the works of this centralization of its technical work is clearly shown by the character of the report made. When the supervision of the work is placed in the hands of three or four independent departments, as is so often the case in small cities, the inability of any one department to command the services of experts has the effect of making much work insufficient and extravagantly inexpensive, if the term may be permitted. The possibilities of co-ordination of the work are well exemplified in this report as well as the greater economy and higher standard of efficiency. The details of the report will be treated later in another department of the magazine. A few illustrations taken from the report are shown this month giving some idea of the improvements in streets, and presenting an opportunity to compare the municipal crushing plant with the larger one belonging to the city of Boston, an illustration of which is also given.

Municipal Manual for the City of Altoona, Pa., 1901-02. 132 pp. W. J. Hamor, City Clerk.

In addition to the directory of city officials, committees, meetings, by-laws, charter provisions, rules and orders of business, statements of appropriations, the manual contains a summary of the city's finances, statements of water department facilities, rainfall, water rates, extracts from Board of Health report, summary of sewer system, including sewage disposal plant, of

paving, including ordinances regulating the subject of fire and police departments. There are also lists of former city officials, reports of election returns of all city officials and abstract of election laws, and some miscellaneous information about the city. For a vest pocket-sized book it contains a vast amount of information of value to citizens and to students of municipal statistics.

Twenty-sixth annual report of the Bangor Water Board to the city council. Arthur Chapin, mayor and president; Melville A. Sinclair, superintendent.

This plant is now run by water power with a reserve steam plant for use in case of accident to wheels or pumps or anchor ice. Power is furnished to the city's electric light plant without charge, and, by order of the city council, water estimated to be worth $8,258 a year is furnished to various city departments without charge. Every cent of charge for water to consumers has been collected before the end of the year for each of the past four years. The receipts for water are given in the board's report as $52.02; in the auditor's report as $60,843.75; in the collector's report as $60,300.68, and in the itemized account of receipts and expenditures as $60,897.90. Expenditures include $14,788.82 for maintenance, $4,803.17 for operating pumping station, $3,103.65, for construction, $879.12 for meter account and $30,710 for interest. The average pumpage is 2,903,920 gallons a day. There is no statement of the cost of the works. A combination of the water and electric light plants and a clear system of accounts and report, like the village of Herkimer, would be of value certainly to the student of the reports and probably to the operation of the plant. Neither Bangor nor Herkimer consider the question of the justice of requiring patrons of the city plants to pay for such uses of light and water as are common to all citizens and for which many of them do not pay under the present system.

Personal Notes.

Charles A. Bookwalter was elected mayor of Indianapolis, Ind., Oct. 8.

W. H. Hoffman, a member of the city council at Washington, Ind., died Oct. 24.

Dewitt C. Smith, ex-city engineer of Schenectady, N. Y., died Oct. 6, aged forty-eight years.

Hon. Matthew G. Emery, the last mayor of the city of Washington, D. C., died Oct. 12, aged 83 years.

James I. Webb has been appointed assistant engineer at the water works pumping station, Toledo, O.

W. W. Follett, consulting engineer, has established offices in the Kittridge building, Denver, Colo.

H. C. Hollinger, former street commissioner at Lebanon, Pa., died suddenly of heart disease Oct. 12.

Philip Prioleau has been reappointed city engineer at Jacksonville, Fla., which position he has held for a number of years.

The R. H. Tingley Company, consulting engineers, has removed its office from 102 Fulton-st. to 32 Broadway, New York City.

Allen L. McDermott of Jersey City, N. J., has been appointed receiver of the City and Suburban railway, of Washington, D. C.

Prof. H. S. Carr of the electrical engineering department of the University of Kansas, has resigned to go into business at Cleveland, O.

C. F. Mohr, F. L. Sanborn, F. A. Rhyme, E. C. Moran and J. H. Wells have been appointed members of a water commission at Portage, Wis.

William Pittman of Jerseyville, Ill., has been appointed manager of the Niedringhaus water works plant at Gabaret Island, near Granite, Ill.

William C. Bryant, Richard H. Laimbeer and Frederick Kellogg have been appointed commissioners to take charge of the Brooklyn end of the rapid transit tunnel.

Ernest L. Ransome, Assoc. Am. Soc. C. E., has established an office at 11 Broadway, New York City, as consulting engineer for concrete steel construction.

John Tinkler was elected a member of the board of water works trustees at Bradford, O., Oct. 14, for three years, David Arnold for two years, and B. A. Wyall for one year.

E. M. Scofield, formerly manager of the Youngstown plant of the American Bridge company, has been engaged to build and manage the new bridge works at Groton, N. Y.

William Easby, jr., has been appointed assistant professor of civil engineering at the University of Pennsylvania and A. W. Schramm assistant professor of electrical engineering.

W. L. Miller has resigned as city engineer of Winona, Minn., to take charge of the construction of a large electrical plant for the Missouri river power company at Butte, Mont.

A. W. Chambliss has been elected mayor of Chattanooga, Tenn. Capt. Charles A. Lyerby was elected president of the board of councilmen, and E. J. Dillard president of the board of aldermen.

Julius W. Bugbee, for a number of years chemist of the sewage disposal works at Worcester, Mass., has been engaged for similar work at the disposal works recently completed by the city of Providence, R. I.

Carl Radlich, constructing and supervising engineer for the Austrian government, is visiting America. He is considering the letting of contracts for work amounting to $150,000,000 in building railways, canals, public highways, etc.

Robert P. Woods, city engineer of Wabash, Ind., for the last six years, has tendered his resignation to accept the position of chief engineer of the syndicate which is building the Ft. Wayne and Southwestern road, the Indianapolis and Shelbyville line, and the Central Traction lines. Mr. Woods's headquarters will be in Indianapolis.

MACHINERY AND TRADE.

Limoid.

A new preparation of lime is now on the market, which obviates the difficulties met with in the use of lump lime. There is no subsequent slaking of limoid, so that there is no heating in the process of forming the putty of lime and there are no particles of unslaked lime remaining to cause swelling and pitting. Large quantities of the new preparation have been used in the middle West during the past year with great success, and it is now being introduced into the eastern markets by The Charles Warner Company of Wilmington, Del., Philadelphia and New York. Their product is made from the celebrated Cedar Hollow lime of Chester county, Pennsylvania, and the same care and watchfulnes in regard to the uniformity and correctness of its chemical composition is exercised that is usual in cement plants, thus insuring a uniform product.

For general building purposes limoid is mixed with water in sufficient proportion to reduce to putty and the proper proportions of sand, hair, plaster, etc., may be added immediately if desired.

Trade Publications.

The Atlas Portland Cement Company, 143 Liberty street, New York, publishes for distribution in booklet form W. A. Rogers's valuable paper on "Railroad Concrete Masonry," which first appeared in the Railroad Gazette. The article is quite detailed and Mr. Rogers's experience enables him to give his readers a most practical exposition of the methods of using cement concrete for masonry, including manufacture of the material and method of putting in place.

The Barrett Manufacturing Company of Cincinnati, O., issues a neat circular descriptive of their asphaltum coating for use on roofing papers and felts, which can be applied to old roofs as well as to new material.

Circular No. 63 of the Jeffrey Mfg. Co. of Columbus, O., is intended to give a general idea of the machinery they manufacture, including the various kinds of conveyers, elevators, screens, crushers, cars, buckets, chains and coal mine equipments.

The United States Sanitary Co., Washington, D. C., issues a handsome little illustrated catalogue showing the various forms of their odorless steel vehicles for garbage, night-soil, ashes, etc., and the methods of using them. Pumps and hose for emptying cesspools and vaults are also listed, as well as refuse cans. The company reports good demand for its wares and has recently disposed of several carts equipped with air-tight packings and the pumping appliances for odorless excavating purposes.

A paper giving full analyses and description of petroleum from the Beaumont, Texas, field, by Clifford Richardson and E. C. Wallace, is reprinted from the Journal of the Society of Chemical Industry for July, 1901, by Eyre & Spottiswoode of London, to show the value of the oil and its limitations.

Trade Notes.

ASPHALT.

The Northern New York Asphalt Paving Company, Troy, N. Y., has John H. Gleason, Patrick H. Feeley, Thomas F. Powers and Patrick Lillis directors. John H. Gleason was elected president and Patrick H. Feeley secretary and treasurer.

The plants of the St. Louis Asphaltum and Paint Co. and the Pikrite Asphaltum and Paint Co., on Gratiot-st., between Twelfth and Fourteenth, St. Louis, Mo., were destroyed by fire Oct. 11, entailing a loss of about $15,000.

The Erie Paving Co., of Toledo, O., will furnish the asphalt blocks for paving in Windsor, Ont.

The proposition of Hetherington & Berner, of Indianapolis, Ind., providing that the city of Detroit, Mich., pay them $1,250 to partially cover the damage and expense sustained by reason of the city's non-fulfillment of contract for a stationary asphalt plant, was accepted and filed, according to press reports.

The Ecolie Co., composed of Santa Barbarans, will soon open a new asphalt mine near More's Landing, Cal. The company is capitalized for $200,000.

The Caddo Asphalt Co., east of Ardmore, I. T., has recently organized and will operate on a more elaborate scale than heretofore.

A deposit of sand asphaltum has been found a short distance from the Northern Pacific railroad in eastern Montana, and will be developed by Col. O. P. Chrisholm, of Bozeman, who owns it. The asphalt is suitable for street paving, and will be used in the streets of Helena, Butte and other Montana cities.

BRICK.

The Enterprise Paving Company has been organized at Pierre, S. D., by Wm. M. Breyfogle, H. B. Clark and T. P. Estes.

The Improved Brick Company has been organized at Salt Lake City, Utah, to manufacture brick, tile and sewer pipe. The officers of the company are: President, Jas. F. Woodman; vice-president, Moylan C. Fox; treasurer, Ferd. J. Fabian; secretary, Frank Jungk.

The Eastern Townships Brick and Manufacturing Company, Sherbrooke, Que., has been incorporated to manufacture brick, tile, pipe and other clay products. S. L. Spafford of Lennoxville will be general manager. W. B. Neil, Wm. R. Webster and J. S. Mitchell of Sherbrooke are interested.

The contract for furnishing 2,600 sq. yds. of paving brick to Kalamazoo, Mich., was awarded to the Indiana Paving Brick and Block Company.

Horace Miner of Peoria, Ill., has had tests made of the extensive clay deposits

which he owns near that city, which prove the clay to be of excellent quality for the manufacture of paving brick. He will erect a plant near Peoria.

The Minnesota Clay company of Coon Creek, Minn., was incorporated Oct. 18 for the manufacture of paving brick and tile. The incorporators are: Victor C. Gilman and Geo. H. Shellenberger of St. Paul; J. J. Smart, Humboldt, Ia.; F. D. Kendrick, Bismarck, N. D.; H. E. Humphrey, Minneapolis.

CEMENT.

The establishment of a Portland cement plant is contemplated by A. C. McComb of Amherst, Wis., who has secured an option on a rich bed of marl 3 miles from that city.

The Mineral Limestone Co. has been organized with offices at Oak Grove, Pa. The officers of the company are: President, Ed L. Myers, of Johnsonburg Paper Mill; vice-president, G. W. A. MacDonald, Lock Haven; business manager and treasurer, J. B. Myers, Lock Haven; general superintendent, T. W. Ronion, Lock Haven.

The attempt to organize a syndicate of all the cement companies in Germany has failed. The largest group, the Northwest Central Cement syndicate, has decided to call an extra meeting and to dissolve. The industry is not in favorable condition. The cement works at Langerich, near Osnabruck, are working only eight hours. The works at Wickingsche have reduced wages 10 per cent.

The American Cement Company of 22 S. Fifteenth-st., Philadelphia, Pa., have been awarded a gold medal, the highest award given, at the Pan-American Exposition, held at Buffalo, N. Y., for their "Giant" Portland cement, the "Old Reliable" American Brand. This celebrated brand of cement has been used in many of the largest undertakings in the country, including the Cornell Dam of the Croton Aqueduct System, the Rapid Transit Underground Railway in New York, the Niagara Falls Tunnel and many others.

The Illinois Hydraulic Cement Mfg. Co., Utica, Ill., has been incorporated for $50,000 by Henry H. Zimmerman, A. E. Preuss and Amelia L. Zimmerman.

The stockholders of the Syracuse Portland Cement Company elected directors, Oct. 1, as follows: Edward A Powell, John R. Deutcher, Hendrick S. Holden, Leonard B. Croker, David H. Burrill, Horace White, Charles P. Clark, Wing R Smith and Charles M. Crouse.

Representatives of the cement manufacturing firms of New York, Ohio, Michigan, Wisconsin and Indiana met in Detroit Oct. 7 for the purpose of taking action toward maintaining the price of cement. A committee was appointed to look over the field and report on some suitable action to be taken to maintain the price at a meeting to be held in Chicago on Oct. 28. The committee was composed of John Monahan, Alpena, Mich.; J. B. Patterson, Union City, Mich.; S. B. Newberry, Sandusky, O.; C. F. Wade, Jonesville, Mich.; W. E. Ware, Jackson, Mich.; W. H. Hawley, Huntington, Ind.

The Pacific Coast Portland Cement Company has awarded part of the contract for the electrical equipment of its proposed plant at Vancouver, B. C., to the Bullock Electric Mfg. Co. of Cincinnati, O. The contract calls for three 750-kilowatt generators for general power purposes, 60 motors varying in size from 7½ H. P. to 150 H. P.

The establishment of a plant at Trio, Williamsburg county, South Carolina, for the manufacture of brick, lime and cement is contemplated by Leonard C. Register.

The New England Pipe and Cement Company, with principal office and chief works at Boston, Mass., has been incorporated to manufacture, purchase and sell all kinds of pipes and tubes, cement, lime and other building material. The incorporators are E. R. Kemp, Freeland Jewett, Edward Morrison and Louis Kammer of Boston and Charles W. Ellis of Newton, Mass.

The plant of the Peerless Portland Cement Company, Union City, Mich., is being remodeled.

The Ironton Portland Cement Company, Ironton, O., has been incorporated.

The Virginia Portland Cement Company, Craigsville, Va., will enlarge the capacity of its works.

A new cement company is reported as negotiating with the Toronto, Ont., city council for a 10-acre site for a factory on Ashbridge marsh.

The John Rosenfeld's Sons of San Francisco, Cal., purchased Oct. 6 140 acres of land four miles from Suisun, Cal., and will erect a Portland cement plant. The company is known as the Eureka Portland Cement Company.

W. J. Dingee, president of the Contra Costa Water Company, Oakland, Cal., contemplates the establishment of a Portland cement mill near Placerville, Cal.

Schuyler S. Olds of Lansing, Mich., has been elected president of the Elk Rapids Portland Cement Company, Elk Rapids, Mich., to succeed O. F. Jordan.

The Lehigh Concrete Stone Company, Phillipsburg, N. J., has been incorporated to make artificial stone of cement and other ingredients.

The establishment of a large cement plant near Menominee, Mich., is contemplated, according to press reports.

The Stowe-Fuller Company of Cleveland, O., have commenced the erection of a large Portland cement plant at St. Louis, to be known as the St. Louis Portland Cement Company. It will have a capacity of 2,000 barrels per day, with a broken stone crusher plant having a capacity of 1,000 tons per day. It is claimed that the material from which the cement will be manufactured is among the finest in the country. The plant will have the advantage of a cheap fuel supply.

LIGHT, HEAT AND POWER.

The Saline Acetylene Lighting Company, Saline, Mich., has been incorporated.

The Oak Park Yaryan Company, Oak Park, Ill., has been incorporated to operate water, light, heat, power and refrigerating plants, by Edmund A. Cummings, Chas. E. Bolles and Willis S. Herrick.

The Southern Electrical Supply Company, Norfolk, Va., has been incorporated to manufacture and sell electrical supplies. The officers of the company are: President, H. W. Summers, Philadelphia; vice-presi-

dent, W. T. McCriety, Norfolk; general manager, A. M. Palmer, Norfolk.

Newly incorporated lighting companies: Poughkeepsie Light, Heat and Power Company, Poughkeepsie, N. Y.; Broome County Electric Company, Binghamton, N. Y.; Illinois River Valley Electric Light, Power and Railway Company, Ottawa, Ill.

MISCELLANEOUS.

A combination of fifty-three stone companys of Pennsylvania is proposed, according to press reports, to include fourteen sandstone and thirty-nine limestone quarries.

One of the largest independent bridge works in the country will be built at Wheeling, W. Va. It will be the outgrowth of the Columbia Bridge Company which has a small plant operating in Carnegie, Pa. A modern plant will be built at a cost of about $1,000,000.

The Trinidad Electric Company, Ltd., has been organized by American and Canadian capitalists for the purpose of acquiring the Trinidad Electric Light Company and the Belmont tramways now operating in Port Au Spain, Trinidad, B. W. I. F. S. Pearson and Sir William Van Horn are interested. T. W. Teele, formerly of the Boston elevated railroad, is interested.

The Shepler Water Motor Company has been organized under the laws of New Jersey by B. E. Shepler, John Williams and Harvey W. Harmer of Clarksburg, W. Va., and Peter Whitney of New York City. A large plant will be established at Clarksburg and water motors will be made under new patents.

The Austin and Western Company secured the contract for a new stone crusher for Traverse City, Mich., for $1,200.

The Western Consolidated Stone Company has been incorporated to control the crushed stone and granite business west of the Alleghanies and north of the gulf states. The following companies are included: Illinois and Wisconsin Stone Company, Chicago, quarry at Berlin, Wis.; Green Lake Granite Company, Green Lake, Wis.; Waupaca Granite and Crushed Stone Company, Waupaca, Wis.; Berlin Granite Company, Berlin, Wis.; Belderman Granite Company, quarries in Wisconsin.

The Nelson Paving Company of San Antonio, Tex., was incorporated Oct. 16 by J. H. Buggs, J. P. Nelson and J. Simpson.

SEWER PIPE.

The Shawnee Sewerage and Drainage Company, Shawnee, Okla., has ben incorporated by C. R. Debruler, Walter Newman and F. M. Richards.

The Sterling Sewerage company, Greenport, N. Y., has been incorporated to manufacture and sell sewer pipe and all sewerage appliances.

Plans and specifications for the new sewer pipe building at Irondale, O., have been completed. They provide for a three-story building.

The statement made under this heading in October that the Red Wing Sewer Pipe Company, of Red Wing, Minn., had filed a petition in bankruptcy is incorrect. The report was accepted on the authority of an exchange which confused it with a personal matter entirely unconnected with the sewer pipe company. The Red Wing Sewer Pipe Company is enjoying the prosperous times which are now in vogue and owes no one anything. The error is unfortunate, but was made by us in accepting the statement of a contemporary whose reputation for correctness of statement is very high.

Recent Inventions.

676,785. June 18, 1901. Mold for Concrete Construction. Philip T. L. Toelpe, Neumunster, Germany. A crib with metal standards having slot to operate removable fasteners of planks or plates which serve as sides of molds for concrete wall.

676,842. June 18, 1901. Penstock Motor. Allen Ferguson, One Thousand Springs, Idaho. An endless sprocket chain operated by flow of water through penstock, and lifting on upward course a smaller amount of water to a distance above the supply.

676,888. June 25, 1901. Electric Railway System. Emmerich Frischmuth, Germany, assignor to the Siemens & Halske company of America, Chicago, Ill. An underground slotted conduit with contact piece for transmitting current to car capable of revolving so as to be removed through the slot.

677,109. June 25, 1901. Hot Water Pipe Conduit. Homer T. Yaryan, Toledo, O. A conduit having top, bottom and side sections formed of three boards separated by blocks and closed by boards along margins forming air spaces, all being covered with tar paper, the conduit space being packed with non-conducting material about the pipes.

677,202. June 25, 1901. Appliance for Scraping Sewers or Drains. William H. Gibbs, Chatham, Eng. Bars arranged about a central stem in spiral form, the system as a whole revolving so as to scrape the surface of sewer.

677,226. June 25, 1901. Method of Producing Electrical Energy from Carbonaceous Materials. Hugo Jones, Chicago, Ill. The steps are reduction by heat of metallic sulphate to the metal and sulphur dioxide, which reduces ferric chloride in solution to ferrous chloride, the solution being separated from liquid nitric acid by a narrow column of sulphuric acid at a temperature evaporating the nitric acid at a temperature evaporing the nitric acid entering it, combining the iron solution with the nitric acid in a galvanic cell, thus changing the ferrous chloride to ferric chloride, and generating an electric current, and combining the metal with an electronegative substance in a galvanic cell.

677,349. July 2, 1901. Adjustable Curved Ruler. Prince A. Gagarin, St. Petersburg, Russia.—A flexible strip for a ruler curved by the action of a double series of bell cranks and held in any adjusted position by a screw on a gauge.

677,448. July 2, 1901. Wheeled Earth-Scraper. William H. Forker, Meadville, Pa. Means of fixing motion of lifting scraper and a tailboard and chain for automatic dumping and reclosing.

677,457. July 2, 1901. Apparatus for Calcining Cement. B. B. Lathbury, Philadelphia and H. S. Spackman, Ardmore, Pa. A rotary cement kiln, conveyor for clink-

er to cooling chamber, apparatus for drawing air through cooler and discharging by blower into kiln carrying powdered coal fuel, with necessary conveyors and tubes.

677,522. July 2, 1901. Trench Digging Machine. John H. W. Libbe, Toledo, O. A self-propelling frame on wheels, track beam, tripping scoop traveling thereon and having mouth with cutting edge and bail adapted to expand it when drawn along.

667,538. July 2, 1901. Excavating Apparatus. Richard Dalton, Wilmette, Ill. A rotating wheel with arms bearing scoops arranged laterally along the face of the wheel to overlap their action.

677,570. July 2, 1901. Apparatus for Coating Iron Pipes. Mertland M. Hedges, Chattanooga, Tenn., assignor to the Chattanooga Pipe and Foundry Company, same place. An oven for heating pipes with various discharge openings, inclined trays to deliver pipes to tank containing coating material, rotating shaft for lifting pipes from tank drip tray.

677,649. July 2, 1901. Combined Box-cap and Shoe-plank holder. Thomas C. Farrell, Washington, N. J. A mold for forming concrete walls, comprising shoe-planks, combined box-caps and shoe-plank holders, and bolts passing across the wall between the holders.

677,817. July 2, 1901. Slide Rule. Edwin Thacher, Paterson, N. J., assignor of one-half to Edson M. Scofield, Youngstown, O.

677,849. July 9, 1901. Electric Railway. Frank M. Ashley, New York, N. Y. A main conductor in a tube insulated, but leaving bare portions and contact devices passing through the tube making contact with the bare portions and protected by flexible sealing strips, where it passes through the tube.

678,010. July 9, 1901. Plastering Composition. Henry C. McMillin, Clarksburg, W. Va., assignor of one-half to Patrick F. McDonnell, same place. Calcined plaster, 60 pounds; domestic cement, 40 pounds; sharp, clean sand, 250 pounds; sulphate of zinc, 2 ounces; grape sugar, 8 ounces; hair 8 ounces; water, 160 pounds.

678,118. July 9, 1901. Heating Attachment for Culverts, etc. Herman O. Kruschke, Aurorahville, Wis. Portable heater, heating pipe to insert in culvert, rest on frozen matter and gravitate as it is melted.

678,195. July 9, 1901. Third-Rail Insulator. William B. Potter, Schenectady, N. Y., assignor to the General Electric company of New York. A body of insulating material with a cavity in its upper end and a metal cap with a hole, opposite the cavity, and a depending, tubular pin, the cap being attached by filling with molten metal through the tubular pin and forcing the metal into all interstices.

678,213. July 2, 1901. Electric Railway John M. Anck, Philadelphia, Pa. A non-conducting, closed conduit with two longitudinal grooves; an insulated main-feeder in one groove; a hollow, flexible conductor in the other, with a coiled spring forming connection between the two and actuating the latter; means on the car to raise it into contact with a sectional conductor within the conduit, also an exterior sectional contact-rail.

678,312. July 9, 1901. Electric Conveyor. John G. Gilmer, St. Petersburg, Fla. A rectangular conduit, grooved guide-rails on top and bottom in which conductors are supported, rails on bottom on which run motor and carriers.

678,365. July 16, 1901. Centering Support. George H. Kunneke, New York, N. Y., assignor to the New Jersey Wire Cloth company, Trenton, N. J. Metal hangers over floor beams to support temporary timbers below the beams which in turn support centering for laying floor, all being afterward removable, except hangers, which are cut off.

678,412. July 16, 1901. Process of Burning Cement, Gypsum, etc. Wilhelm Lessing, Gesecke, Germany. Consists of warming and drying broken raw material by waste heat from kiln, grinding and heating to a white heat and slowly dropping against a column of fire.

678,543. July 16, 1901. Combined Dumper and Spreader. Geo. F. Conner, Port Huron, Mich. A wagon with dumping hopper having independently hinged sections, with means for regulating openings, and a spreading device to distribute material as discharged.

678,605. July 16, 1901. Culvert. Clarence Wolcott and Patrick MaGirl, Bloomington, Ill. A series of reversible ribbed metal plates breaking joint with overlapping parts for locking together, formed into an arch.

678,821. July 16, 1901. Device for Applying Rail-bonds to Rails. Morris F. Whiton, Hingham, Mass., assignor to Chase-Shawmut Co., Boston, Mass. A rail-engaging frame, two arms independently pivoted, having bond receiving supports which hold the bond in position to be applied to the rail.

678,918. July 23, 1901. Ram Machine for Paving. Wilhelm Timm, Berlin, Germany. A tube supported on feet having rollers, a ram block moving in the tube and levers and chains for lifting and dropping the rammer.

678,979. July 23, 1901. Apparatus for Spreading Liquids onto Filter Beds. Geo. E. Ridgway, Brentwood, Ashley, England. A pillar, troughs radially arranged about and supported by it, a sewage supply main discharging tangentially at the axis of the trough motion against vanes, thus revolving the system of troughs and distributing the sewage over the subjacent bed.

679,286. July 30, 1901. Street Sweeper. James V. Allen, Ontario, N. Y. A casing supported on wheels, with its bottom near the ground surface, a pan on the bottom removable through the front of the machine, a brush in the rear with a housing covering it, except where it is in contact with the street surface, and supplying an inclined surface for sweepings to be swept into the pan, the brush being rotated by the motion of the wheels supporting the machine.

679,291. July 30, 1901. Wheeled Earth Scraper. James M. Brooks, Molena, Ga. Wheels on an arched axle, supporting a V-shaped frame on which is hung a scoop, a tongue carrying draft arms pivoted on the frame and draft hooks engaging projections on the scoop when lowered to working position.

679,427. July 30, 1901. Vitrified Brick. Marie J. Magarity, Wilmington, Del. A combination of clay, hornblende and silica and mica schist giving respectively plas-

ticity, density, freedom from shrinkage and fluxing property.

679,536. July 30, 1901. Filter. Thomas E. McCann, Philadelphia, Pa. A pier filled with filtering material coarse where water enters and finer behind and means for controlling flow of water through the filter horizontally to outlet on other side; also apparatus for handling materials in filter.

679,681. July 30, 1901. Sand Point. Milton Latta, Burwell, Neb. A perforated tube with spiral rib outside on which wire cloth is wound in a special manner and secured, forming a strainer.

679,828. Aug. 6, 1901. Manufacture of Artificial Stone. Prosper Cabrie, New York, N. Y. The process of making artificial stone with rough surface, comprising a mixture of slowly-hardening Portland cement, quickly-hardening Portland cement, hydraulic lime slaked with water acidulated with sulphuric acid and sand, poured into a mold to set, the mold removed and the surface roughened, allowed to dry and then washed with a 20 per cent. solution of muriatic acid.

680,016. Aug. 6, 1901. Shut-Off Nozzle for Firemen's Hose. Jas. M. Baker, Providence, R. I. Combination of revoluble nozzle-tube, sliding valve tube and closing seat for same.

680,098. Aug. 6, 1901. Pump. Wm. C. Whittaker and Walter V. Turner, Raton, N. M., assignors to Wm. C. Whittaker, Walter V. Turner, Alfred Peterson and Edgar W. Fulghum, same place. Windmill with double and single acting pump and appliances for changing from one to the other according to force of wind.

680,228. Aug. 13, 1901. Apparatus for Calking and Cutting Pipe. James Couston and James Finlayson, Perth, Western Australia. A calking machine, including frame to surround pipe, pair of rings, rotable, transverse ways with presser disks and means for forcing disks toward each other.

680,246. Aug. 13, 1901. Method of Slaking Lime. James H. Harrier, North Industry, O. Method of exposing quick lime to water on inclined surface and then excluding the air by a covering of pulverized slaked lime.

680,250. Aug. 13, 1901. Push Wagon for Street Cleaning Purposes. Thomas Hill, Jersey City, N. J. Wheels on axles attached to inverted U-shaped side frames, to which push handles are attached; these frames being attached to platform, having a small follower wheel, and supporting the refuse receptacle.

680,251. Aug. 13, 1901. Push Wagon. Thomas Hill, Jersey City, N. J. Similar wagon to 680,250, but with through axle, refuse receptacle in front of axle, and the small supporting wheel in front.

680,432. Aug. 13, 1901. Cement Post Molding Machine. Leo G. Haase, Oakland, Ill. A molding tube in a supporting frame, a ring for rounding and marking top of molded post, and a plunger acting from below; first as base of mold, and then as means for lifting post out of mold.

680,856. Aug. 20, 1901. Street Sweeper's Cart. Frederick Haberman, New York, N. Y., assignor to National Enameling and Stamping Company, same place. Supporting wheels, U-shaped frame on each wheel, one leg forming handle at top and one forming part of frame connecting wheels and supporting refuse can, with small following wheel as third point of support.

680,886. Aug. 20, 1901. Wheeled Scraper. Charles Rath, Los Angeles, Calif. A main frame supported on two wheels, scoop, cranked axle pivoted on main frame, rigid frame on this axle with arms for holding axle in adjusted position, and movable draft-rigging connecting with other arms by flexible connections.

680,974. Aug. 20, 1901. Automatic Flusher for Sewers or Drains. Patrick J. Healy, Hydepark, Mass. A frame of longitudinal bar with two or more attached cross bars, holding a bulkhead which can turn in one direction on one cross bar unless held in position by an attached hook and eye; with a collapsible tube about the edge of the bulkhead.

681,138. Aug. 20, 1901. Hoisting and Conveying Apparatus. Joseph L. Potter, Indianapolis, Ind. A hollow longitudinally-open hoisting and conveying car for sewer-trench digging, having a pivoted arm with platform for operator and guide wheels for the bucket-hoisting cables, means for hoisting and lowering buckets and a pair of operating cables worked from a distant power house.

681,158. Aug. 20, 1901. Conduit. Charles A. Wanner, Philadelphia, Pa. A conduit quadrangular in section having longitudinal grooves in top and one side and short lugs on the other two sides to fit in the grooves of adjoining conduits of same kind.

681,248. Aug. 27, 1901. Paving Block. John McLachlan, Chicago, Ill. Compressed oil-saturated, natural, fibrous blocks held without further compression in fixed relation on suitable base and side supports.

681,364. Aug. 27, 1901. Concrete Floor. Constant Eliet, Lorient, France, assignor to himself and Gustav Louis Mouchel, London, Eng. A concrete body with metal tension bars in upper portion, and compression bars in lower portion over points of support; horizontal and vertical shear-bars embedded in the concrete in proper locations; curved tension bars embedded so that they are near the bottom between supports and near the upper surface over supports; curved compression bars embedded so that they are in opposite positions.

681,375. Aug. 27, 1901. Means for Aligning Drills. Wilson Reed, Norfolk, Va. A frame of double tripod form having triangular ends, a drill-holder and braces to adjust the double-holder within the frame.

681,493. Aug. 27, 1901. Garbage Receptacle. Wm. T. Cameron and Wm. A. Purks, Philadelphia, Pa. A swinging box with gudgeons fitting supports with matching eyes for insertion of locking pin.

681,514. Aug. 27, 1901. Street Sweeper or Cleaner. Otto Schumann, Philadelphia, Pa. A street sweeper with refuse box and a bucket, into which broom sweeps material and which then tips it into the box, oscillating automatically.

611,580. Aug. 27, 1901. Process of hardening artificial stone or the like. Carl Rensing, Berlin, Germany. The articles are subjected to air under 6 atmospheres pressure, followed by steam at higher pressure.

SELECTIONS FROM THE PRESS.

A Concrete Dwelling.

The last and most important example of concrete construction in building is found in the case of one of the large railway companies whose shop buildings, with one exception, have concrete walls and foundations, and some of them also floors and roofs of the same composition. The general plan of construction was the usual one of pouring the concrete into moulds, built of tongued and grooved pine boards, special wooden frames being used where necessary. The buildings call to mind what was, in all probability, the earliest practical venture in this field, made by Mr. W. E. Ward about a quarter of a century ago, and described by him a short time thereafter in a paper read before the American Society of Mechanical Engineers. Mr. Ward's enterprise took the shape of a building for dwelling purposes in which not only the external and internal walls, cornices and towers were made of concrete, but all the beams, floors and roofs as well, reinforced with light iron beams and rods. Furthermore, all the closets, stairs, balconies and porticos, with their supporting columns, were moulded from the same material. The only wood in the whole structure was in window sashes and doors, with their frames, and in the stair rails, thus excluding everything of a combustible nature from the main construction. Indeed, it was the desire for something of thoroughly fireproof character that seemed to have, to a great exent, inspired the undertaking. The exterior portions, too, of the house, which were more or less ornamental in their functions, were made of concrete in place during the progress of the work, and in the interior the cornices, ceiling and wall panels and other details were of the same material, covered afterward with the finish usual in such work. There were a number of other features about the house which helped to add to its interest, but the character of the structural material constituted its primary claim to attention.—From Cassier's Magazine for November.

Two Sides of the Park Question.

Parks are said to be the lungs of a great city. They are essential, not only to the city's adornment, but to its health as well. When, however, large tracts of agricultural land are set apart as game preserves or for some similar purpose the action must be defended on other grounds.

About one year ago The Register mentioned the project of setting apart several thousand acres in northern Minnesota for a national park. There has been considerable discussion of the plan and an active opposition has developed. The people of Cass Lake, which is within the limits of the proposed park, have adopted resolutions calling on the members of the legislature to annul the memorials to congress, on the strength of which the opening of the Indian reservations to settlement was delayed. These memorials contained the statements that very little of the lands would ever be used for agricultural purposes and the citizens of Minnesota are desirous of having the said lands set aside as a park. Both these statements are declared to be untrue, and the resolutions say that "there is within the limits of said reservations an abundance of lands which, with the application of a reasonable amount of labor, can be made as good for stock raising and general agricultural purposes as any in the state." The resolutions also point out that "inasmuch as the largest part of the arable lands in said state have already been occupied, large numbers of citizens of said state desire to seek new opportunities to establish homes for themselves and families, and to that end it is absolutely necessary that the agricultural lands within the said reservations be placed upon the market for entry and settlement under the laws governing such cases."

These are the statements of the people who live in the vicinity of the lands sought to be included in the park and who know their true character and their true value for agricultural purposes.—American Land and Title Register.

A Successful Pavement.

Many are the experiments that have been tried by municipal authorities to procure the best pavements for the streets of large cities and towns. During recent years the various councils have realized the great necessity of ease of locomotion and comfort of the pedestrian, with due attention to health and cleanliness. This has caused a great variety of paving materials to spring into existence, for the most part to succumb to the test of time. One of the first firms to recognize the advantages of wood as a pavement was Messrs. Armstrong, Addison & Co., timber importers, of Sunderland. They found that to secure the maximum of durability from wood it must be impregnated with a preservative that would render it impervious to the action of the weather. For many years they had treated sleepers for railways with a system of creosoting that made them last three or four times longer than unpreserved wood. This led to their adopting the same system

for wood paving, which consists of forcing creosote oil into the blocks under a heavy pressure until they absorb a minimum quantity of one gallon (equal to 10 lbs.) per cubic foot. There is no difficulty experienced, we are informed, in impregnating beech with 12 to 15 lbs. per cubic foot. They lay their pavement according to their original plan on a Portland cement concrete foundation, 5-in. to 6-in. thick, properly radiated on the surface, the blocks 5 in. or 6 in. in depth, 3 in. in width, and 6 in. to 11 in. in length, set on a thin layer of sand, and the joints run with asphalt and small gravel in proper proportions, the surface of the pavement having an inclination from center of roadway to channel. By this process Messrs. Armstrong, Addison & Co. claim to have solved the question of durability of wood pavement. The advantages claimed are that it is comparatively noiseless, it diminishes the wear and tear both of vehicles and horses, and that it is cleanly is shown by the fact that only one-third of a cart load of mud is taken on the average from 1,000 yards of wood-paved streets, as against two cart loads from streets paved with granite, and four loads from macadam. The creosote, pressed into the wood by steam power at a heavy pressure, hardens the surface of the blocks, enabling them the better to resist climatic changes and decay, and at the same time acts as a disinfectant and prevents the absorption of offensive matter.

Some twenty years ago this firm laid an experimental strip on the bridge at Sunderland, and since that time many thousands of yards of fir and beech pavement have been used in Sunderland, London, Newcastle, Lancaster, Manchester, Leeds, Hexham, Berwick-on-Tweed, Keighley and many other places.—The Municipal Journal, London.

Beer in Sewers.

Burton—the town of breweries—has an interesting sewage problem to grapple with. An enormous amount of refuse, varying from five to seven million gallons per day, is poured into the corporation sewers every day by the brewers, and unless this waste is subject to special treatment is liable to become an intolerable nuisance to everybody for a long distance round about. The sewage is treated on land with caustic lime, about forty to fifty grains per gallon being required, which is out of all proportion to the amount used for ordinary domestic sewage. The corporation's farm is about 717 acres in extent, of which 515 acres are available for the treatment of sewage, and by a bill now before parliament powers are sought to extend the farm by taking in another 100 acres. In giving evidence before the parliamentary committee Mr. G. T. Lynam, the corporation's engineer, said before they used the lime ten years ago they only had three-fifths the present area of land, and the condition then was very serious. The slough from the raw sewage then left upon the land was very troublesome indeed, and the result was that the corporation was sued, and an injunction was granted. Its condition was very different now. There is some opposition to the extension, and it was urged by counsel for the opposition that the land was covered with a sort of glutinous film, and that poisonous gas was emitted—a statement which was denied on behalf of the corporation.—London Municipal Journal.

Manufacture of Concrete Paving Slabs.

The granite used is broken to pass a 3-16 sieve and carefully washed, as the dust acts as a coat around the pieces and prevents the cement laying hold. A good washing machine is provided by a slanting archimedean screw working in a trough, with openings in the thread of the worm. The water is run in at the high end and the granite put in at the lower; the screw churns the pieces over each other and carries them up by its motion, and the clean water meets the cleanest granite. About 8 per cent. by weight is washed out as waste. The cement used should be best Portland to stand 400 lb. per square inch after seven days' immersion; before use it is laid out to cool for fourteen days, under cover, and is turned over frequently during that time. The stone is made of three parts by weight of washed granite and one of cement, thoroughly incorporated in a dry state, and afterwards water is very sparingly added. At each mixing there is made sufficient concrete for a 2-ft. 6-in. by 2-in. slab only, and when ready for putting into the mould it does not appear to the eye to be sufficiently wet. The moulds should preferably be metal-lined, true in shape, with clearly-defined arrises, oiled over before the concrete is placed in them, and then placed upon the trembler, which is a machine designed to give a rapid vertical jolting motion to the mould. When the machine is started the concrete is placed in the mould by small shovelfuls at a time, and two men with trowels spread it over the moulds. When filled they pat it over with a trowel, the moisture rises to the surface, and an even smooth surface is obtained; the mould and concrete are then removed to a rest for

two days, the operation of mixing and making each slab taking about six minutes.

The slab when two days old is taken from the mould, air-dried for seven or nine days, and then immersed in a silica bath for seven or nine days more. The soluble silica for the induration of the stone is a clear viscous substance, made from pure flint and caustic soda, which are digested by heat under pressure in Papin's digester or an analogous machine. Its strength is technically known as 140 deg. Twaddle, which shows 1,700 on a hydrometer. The silica is diluted with water until it shows 1,250 or 1,300 on the hydrometer, and is then a clear copper-colored liquid. The value of the silica bath is in hastening the hardening of the stone, which at the end of one month will stand from 30 to 40 per cent. more tensile strain if silicated than air-dried only, although it is doubtful whether silicating increases the ultimate strength of the stone. Stone prepared in this manner should stand a tensile strain of 700 lb. per square inch at the end of three months and attain its ultimate strength in twelve months. Preference has been shown by some for stones made by machinery under hydraulic pressure, and probably one of the best machines now on the market for this purpose it that supplied by Messrs. Fielding & Platt, of Gloucester, which, with one man to work it, can turn out slabs at the rate of twenty-five per hour.—The Surveyor, London.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

West Bay City, Mich.—Under the ordinance providing that only brick or cement walks shall be built within the city limits, more substantial walks have been constructed in this city this year than in five previous years.

Bloomington, Ill.—In the suit of Henry O. Wheeler vs. the city of Bloomington for $5,000 damages for alleged injury to lots on W. Front-st. by raising the grade of the street, a verdict was rendered in favor of the city Oct. 9. This will put an end to a number of similar claims against the city from the same locality.

Wilmette, Ill.—Suit has been filed in the circuit court to recover damages to property caused by the laying of a defective pavement. The pavement was laid by Wm. McGreer of Chicago under the supervision of George W. Springer and Charles S. Clark of the board of local improvements. The specifications called for a hard, smooth and durable pavement of crushed limestone and crushed gravel. Gravel mixed with clay was substituted. Antoinette Gage, the plaintiff, charges collusion betwen the contractor and board of public improvements, and asks for a judgment of $5,000.

Port Huron, Mich.—The disappearance of wooden sidewalks throughout the city and their replacement by smooth, even and substantial concrete walks is a matter for general congratulation. In the long run it pays to do substantial and permanent work, and the indications are that properly constructed concrete walks will prove sufficiently long lived to render them much more economical than wooden walks.

CONTEMPLATED WORK.

Lancaster, Wis.—The Platteville road will be macadamized.

Elizabeth, N. J.—An ordinance has been passed to pave Trumbull-st.

Morris, Ill.—The question of paving Liberty-st. is being revived.

Green Bay, Wis.—Bids will be asked soon for paving Monroe-ave.

Atlanta, Ga.—Asphalt paving is proposed for Hunter and S. Pryor-sts.

Elkhart, Ind.—The improvement of Fulton-st. has been authorized.

Chicago, Ill.—A municipal paving plant is proposed at a cost of $300,000.

Urbana, Ill.—Brick paving is proposed for three streets. J. W. Ryan, city engineer.

Latrobe, Pa.—The bids for paving Ligonier-st. were rejected as too high.

Pekin, Ill.—Bids will be asked soon for paving around the court house square.

Leavenworth, Kas.—Fourth-ave. will be paved its entire length. Mayor Ryan.

Pittston, Pa.—About 6,000 sq. yds. of macadam paving will be constructed in the spring.

Norfolk, Va.—A resolution has been passed for paving Wolf-st. with asphalt.

Ft. Worth, Tex.—Brick paving is desired for Front and S. Boaz-sts. City Engineer Hawley.

Champaign, Ill.—Park-st. will probably be paved with novaculite as an experiment.

Gibbon, Minn.—Cement walks will be built on First-ave. from Second to Fourth-st.

Petersburg, Ind.—Washington twp. voted Oct. 16 to construct crushed stone roads.

Waterloo, Ia.—Brick paving and cement curbing is contemplated on W. Fourth-st.

Louisville, Ky.—Ordinances have been passed for improving Transit-ave. and an alley.

Adrian, Mich.—A resolution was passed Oct. 14 for paving Church-st. with brick. Mayor Reynolds.

Sedalia, Mo.—A resolution has been passed to macadamize Third-st. from Osage to Lamine.

Moline, Ill.—A new petition is being circulated for paving Seventh-ave. with asphalt.

Midland, Mich.—A resolution has been passed to pave Main-st. Horace D. Holden, cy. clk.

Aurora, Ill.—Petitions have been circulated for asphalt paving on Spring, Clark and Fifth-sts.

Owensboro, Ky.—Main-st., from Triplett to the Litchfield road, will be improved. Mayor Small.

Omaha, Neb.—The park commissioners adopted final plans for the Omaha boulevard system.

Bloomington, Ill.—Asphalt paving is being considered for the four blocks surrounding the public square.

Topeka, Kas.—The property-owners on E. Eighth-ave. have petitioned for brick paving on sand foundation.

Los Angeles, Cal.—A boulevard is being planned which will reach from the heart of the city to Holleywood.

Tampa, Fla.—The county voted Oct. 15 to issue $400,000 bonds for county roads. A. J. Knight, chmn. bd.

Duluth, Minn.—Macadam paving has been petitioned for on Nineteenth-ave. E, between Fourth and South-sts.

Chattanooga, Tenn.—Estimates of the cost of improving Pine-st. will be prepared by the city engineer.

Danville, Ill.—An ordinance is pending for paving and curbing Oak-st., from Madison-st. to the city limits.

Dallas, Tex.—The city engineer was instructed Oct. 14 to ask for bids for paving St. Paul-st. with brick.

Mountain City, Tenn.—The construction of a turnpike road from this city to Cut Laurel Gap is contemplated.

Rockford, Ill.—City Engineer Main advocates the use of creosoted blocks for repaving the girder bridge.

Mankato, Minn.—The question of securing better streets is being discussed. Mayor Peterson; Cy. Engr. Thompson.

Paducah, Ky.—Ordinances have been passed for grading and graveling Ninth, Caldwell, Adams and other streets. Mayor Lang.

Bowling Green, O.—Plans and specifications for improving two streets will be prepared by the city engineer.

Champaign, Ill.—An ordinance is being prepared which provides for concrete walks only in the business section.

Gaylord, Mich.—The construction of a stone road through Otsego county, at a cost of $40,000, is contemplated.

St. Paul, Minn.—The final order for macadamizing Irwin-ave., from Walnut-st. to Pleasant-ave., was passed Oct. 17.

Charleston, Ill.—An ordinance has been passed for building a concrete walk on N. A-st. W. Ed Miller, cy. engr.

Valley Junction, Ia.—The town council has ordered a cement walk built on Fourth-st., between Maple and Railroad-sts.

Des Plaines, Ill.—An ordinance has passed second reading for building cement or concrete walks on Ellinwood and Miner-sts.

Clinton, Ia.—A resolution is pending for paving Sixth-ave., from Front-st. to the river levee. Mayor McDaid.

Lawrence, Kas.—A resolution has been adopted for curbing Ohio-st., from Winthrop to the Sante Fe railroad track.

Nashua, Ia.—The construction of sidewalks in certain streets is contemplated. H. T. Dexter, mayor; H. M. Walleser, town clerk.

Cadillac, Mich.—Plans and specifications for improving N. Simons and Lake-sts. have been adopted. W. J. Smith, cy. clk.

Pekin, Ill.—Bids will probably be asked at once for paving the streets around the public square and N. Fourth-st. with brick.

Hammond, N. Y.—The streets of this village are being surveyed to establish boundaries preliminary to building sidewalks.

Milwaukee, Wis.—The board of public works has decided upon permanent paving for a large number of streets next year.

St. Louis, Mo.—Asphalt boulevards from the south side of this city to the Bellefontaine and Calvary cemeteries are planned.

Denver, Col.—An ordinance has been passed providing for basalt block paving on S. Fourteenth-st., from Colfax to Tenth-st.

Colorado Springs, Col.—The survey for the proposed boulevard to Austin Bluffs has been completed by Engineer H. I. Reed.

Lyons, N. Y.—The taxpayers have petitioned the village board to issue $30,000 bonds for grading and improving the streets.

Erie, Pa.—Ordinances were passed Oct. 14 for repaving French-st., from S. Park Row to Eighth-st., and from Eighth to Eleventh.

Los Angeles, Cal.—The property owners on San Pedro-st., between Second and Fifth, want that street paved with cement walks and cement curbs.

Pasadena, Cal.—Resolutions were passed Oct. 15 and bids asked for grading, curbing and gutters on Ellis-st. and N. Pasadena and Fairmount-aves.

Bay City, Mich.—The board of public works has recommended the construction of walks on a large number of streets. Wm. Cunningham, mayor.

East St. Louis, Ill.—An ordinance was passed Oct. 14 to pave Rock road, from Tenth-st. to the Belt railroad tracks, one mile. Estimated cost, $64,000.

Alexandria, Va.—The street committee reported favorably on the ordinances and appropriations for paving Alfred, Fairfax and King-sts. with brick.

Burlington, N. J.—A resolution has been adopted to grade, curb, gutter and concrete the sidewalks on Elmwood-ave., between North and Spring-sts.

Chicago, Ill.—The board of local improvements has adopted creosoted wooden blocks as one of the standard pavements for the streets of this city.

Oskaloosa, Ia.—The property-owners on E. High-ave., from Ninth to Eleventh, have petitioned for paving, grading and curbing. W. H. Wray, mayor.

South Bend, Ind.—The city engineer has been instructed to prepare specifications for cement walks on Lawrence-st., from Bridge to Division. Mayor Fisher.

Albert Lea, Minn.—A resolution was adopted Oct. 18 directing the city engineer to prepare plans and specifications for paving Broadway and Clark-sts.

Crawfordsville, Ind.—A resolution has been introduced which provides for six feet cement walks, curbs and gutters on Market-st., from Brook-st. to Park-ave.

Hartford, Conn.—A resolution has been passed to macadamize Riverside-st., from Woodbine-st. to the Park river, and to

build walks and curbstones on S. Woodbine-st.

Perth Amboy, N. J.—The property-owners on Washington-st., between State-st. and the river, have petitioned for an 18-inch curbing and a roadway of cinders.

San Francisco, Cal.—Ordinances have been passed authorizing asphalt and bituminous rock paving in certain streets. John A. Russell, clk. Bd. Supvrs.

Topeka, Kas.—A petition is being circulated asking that Tyler-st. be paved. A petition is before the council asking for ourteen blocks of paving in E. Eighth-st.

Atlantic City, N. J.—Ordinances have been passed repealing the ordinances passed for paving S. Carolina, Kentucky, Pacific and Arkansas-aves. and improving Illinois-ave.

Ukiah, Cal.—T. L. Carothers, C. P. Smith and J. H. Barker have been appointed a committee to estimate the cost of building a boulevard from this city to the asylum.

Traverse City, Mich.—(Special.)—This city is making preparations for brick paving early in next year. Bids have been asked on steam road rollers. J. H. Bloomshield is consulting engineer.

Chelsea, Mich.—An ordinance has been passed providing for the construction and maintenance of cement walks in this village. F. P. Glazier, pres't com.; W. H. Hoselschwerdt, clk.

Chicago, Ill.—The board of local improvements will abandon the plan of paving Austin-ave., from Pauline-st. to Western-ave., with brick and use asphalt instead, according to press reports.

Merchantville, N. J.—An ordinance has been passed providing for putting in curbs on all streets now macadamized and also on all other streets as others may hereafter be improved.

Bayonne, N. J.—Asphalt paving has been authorized for Avenue C., two miles long. Asphalt paving is proposed for all the streets in the town. Jas. S. Coward, pres't. Avenue C improvement com.

San Diego, Cal. -The street committee has submitted its report on the proposed boulevard. If constructed this city will be completely encircled and new roads opened to all neighboring resorts.

Toronto, Ont.—Concrete walks have been recommended for portions of Queen, Carlton, Sumach, King and Wellington-sts. and brick paving for Shannon-st., from Ossington-ave. to Dovercourt road.

Washington, D. C.—The district commissioners have ordered bids advertised for cement walks, granite curbs, vitrified or asphalt block paving in certain alleys, etc., under the provisions of the assessment system.

Madison, Wis.—The property-owners on the four streets around the capitol park have petitioned for macadam paving because of its cheapness in cost. The state, however, had appropriated $15,000 for asphalt paving.

Peoria, Ill.—The board of local improvements has decided to pave Wisconsin-ave. with brick on gravel base. Also, to pave next spring, portions of Water, Washington, Lower Adams, Bourland and St. James-sts. and Warner-ave.

St. Joseph, Mo.—Ordinances were passed Oct. 7 for paving Ridenbaugh-st., from Eleventh to Thirteenth, with brick; for the appropriation of $2,500 to repair asphalt streets; to pave Thirteenth-st., from Henry to Lincoln, with brick.

Nashville, Tenn.—This city has made appropriations for paving as follows: Paving public square with brick, $23,100; First-st., with granite, $24,000; Broad-st., from Vine to viaduct, brick, $14,500; Broad-st., from Summer to Vine, granite, $18,500; Church-st., granite, $8,000.

Indianapolis, Ind.—A resolution has been adopted for paving Pearl-st., from New Jersey to East, with brick. Final action was taken on the proposed cement walks on Senate-ave., from South to Merrill, and Greeley-st., from Washington-st. to a point 730 ft. north.

Omaha, Neb.—Ordinances have been passed for paving Twenty-first-st., from Binney to Wirt, with disintegrated granite; grading Dewey-ave., from Thirty-eighth to Thirty-ninth; curbing and guttering Corby-st., from Fifteenth to Sherman-ave. W. H. Elbourn, cy. clk.

Rushville, Ill.—The city council established a new ruling Oct. 9, deciding that hereafter the city would pay only one-half the cost of a brick walk either inside or outside the fire limits, and that if property-owners desire cement walks they may be constructed on these conditions.

Seattle, Wash.—The city council has authorized the issue of an additional $50,000 worth of improvement bonds, to be used for wooden block paving, cement walks, sewers, etc., in a number of streets. An ordinance for a 90-ft. boulevard, from Westlake-ave. and Denny way to Fourth-ave. and Pine-st., has been introduced.

St. Joseph, Mo.—Ordinances have been introduced providing for paving Thirteenth-st., from Messaine to Olive, with brick; brick walks in certain streets; paving Francis-st., from Main to Ninth, with asphalt; Missouri-ave., from King Hill-ave. to Buena Vista addition, with brick; Sixth-st., from Hall to Albemarle, with asphalt.

Oshkosh, Wis.—The improvement committee reported Oct. 15 in favor of rebuilding portions of Merritt, Wangoo, Washington, High and Algoma-sts. It is believed that brick will be used on these streets, except Algoma and Washington, for which asphalt is favored. The property-owners on Bowen-st. have petitioned for Telford macadam paving.

Baltimore, Md.—Asphalt or Belgian block paving has been decided upon for portions of North, Warren and Fulton-aves. and Hanover, McCulloch and St. Paul-sts. Asphalt pavements will be constructed on the following streets; Fulton-ave., from Baltimore-st. to Frederick-ave.; E. Baltimore-st., from Chesapeake-st. to Grove alley; Canton-ave., from Cannon to Luzerne-st.

Red Jacket, Mich.—(Special.)—The village council has authorized Albert J. Marsh, clk., to ask for estimates of the cost of the different kinds of material for street paving and sidewalks, and opinions from engineers as to the best and most suitable material to be used for paving and walks. About 4,000 lin. ft. of paving and 4,000 ft. of sidewalks is contemplated. Council will decide upon the work and material by March 1, 1902.

CONTRACTS TO BE LET.

Youngstown, O.—Sealed bids are asked until 2 p. m. Nov. 11 for street grading and sewer bonds. Wm. I. Davies, cy. clk.

Fowler, Ind.—Bids are asked until Nov. 4 for constructing 25 miles of gravel road. Wm. S. Van Der Voort, co. surv.

Bloomfield, Ind.—Bids are asked until Nov. 4 for building a gravel road in Stockton township. Harvey L. Doney, co. audt.

Fremont, O.—Bids are asked until Nov. 8 for grading, draining and macadamizing E. State-st. E. Schwartz, mem, com.

Winona, Minn.—Sealed bids are asked until 8 p. m. Nov. 4 for constructing 6 foot stone walks. Paul Kemp, cy. rec'dr.

Vicksburg, Miss.—Bids are asked until 12 m. Nov. 4 for grading and repairing hill on road 3. J. D. Laughlin, clk. bd. supvrs.

Springfield, O.—Sealed bids are asked until 7 p. m. Nov. 19 for $3,039.77 street improvement bonds. R. N. Lantz, cy. clk.

Trenton, N. J.—Bids are asked until Nov. 5 for paving Center-st. with asphalt. C. Edward Murray, cy. clk.

New Albany, Ind.—Bids will be received Nov. 5 for paving an alley with brick, according to local press reports. Cy. Engr.

Camden, N. J.—Bids are asked until Nov. 11 for building the Clementon and Gibbsboro gravel road. J. J. Albertson, cy. engr.

Portland, Ind.—Bids are asked until Nov. 4 for constructing a sawed sandstone sidewalk on Robert Huey-st. Horace Antrim, cy. clk.

St. Paul, Minn.—Sealed bids are asked until 2 p. m. Nov. 4 for macadamizing Arcade-st., from E. Seventh to Maryland. C. H. Bronson, clk. B. P. W.

San Francisco, Cal.—Bids are asked until Nov. 4 for 1,337 feet of grading and 828 feet of macadam paving in two roads. Bd. supvrs.

Redwood City, Cal.—Bids are asked until Nov. 4 for macadamizing two portions of county road in first road district. M. H. Thompson, co. clk.

Washington, Ind.—Bids are asked until Nov. 5 for constructing 33 miles of roads in Washington township. W. H. McCarter, chmn. bd. co. com'rs.

Cleveland, O.—Bids are asked until Nov. 6 for grading, draining and planking N. Woodland road, from this city to Orange. Julius C. Darn, clk. co. com'rs.

Lorain, O.—Sealed bids are asked until 12 m. Nov. 11 for building sidewalks. Bidders must designate material, kind and quality. J. J. Mahoney, cy. clk.

Toledo, O.—Sealed bids are asked until Nov. 4 for paving Waite-ave. with asphalt or other blocks on a concrete or sand foundation. J. E. Connell, cy. clk.

Toledo, O.—Bids are asked until Nov. 12 for paving Indiana-ave., Ontario-st. and Parwood-ave. with asphalt block, vitrified brick or block or Kreodone creosoted blocks. J. E. Connell, cy. clk.

Troy, N. Y.—Bids are asked until Nov. 12 for 34,260 sq. yds. of 6 in. and 24,500 sq. yds. of 9 in. brick paving, 26,250 lin. feet of curbing, catchbasins, etc., in Second-ave. Jas. M. Riley, clk. bd. contract.

Wellsville, O.—Sealed bids are asked until Nov. 8 for 11,000 sq. yds. of brick paving, curbing, etc., in Clarke-ave.; until Nov. 9 for 11,504 sq. yds. of brick paving in Lisbon and Commerce-sts. J. W. McQueen, cy clk.

Wellsville, O.—Bids are asked until Nov. 5 for 10,000 sq. yds. of brick paving, 6,400 lin. ft. of curbing and 5,000 cu. yds. of excavation in Clark-ave.; and 6,632 sq. yds. of brick paving in Liverpool-st. J. W. McQueen, cy. clk.

CONTRACTS AWARDED.

Trenton, Ky.—The contract for macadamizing N. Main-st. was awarded to W. T. Vaughn of Hopkinsville, for $1,162.

Seattle, Wash.—The contract for building cement walks in Nob Hill-ave. was awarded to T. Ryan & Co., for $3,904.

Reading, Pa.—The contract for vitrified block paving in Perkiomen-ave. was awarded to Jacob Mayer, for $10,860.

Lanark, Ill.—The contract for macadamizing lower Broad-st. was awarded to David Hearnish, at $8.50 per rod.

Cambridge City, Ind.—The contract for paving Seventh-st has been awarded to A. G. Pugh of Columbus, O., for $7,650.

Neenah, Wis.—The contract for paving Church-st. with macadam was awarded to J. D. Jones and C. H. Watts for $1,815.

Ensley, Ala.—The contract for artificial stone paving in Avenue E was awarded to James Millarky & Co., for $2,500.

Lake Preston, S. D.—The contract for a cement walk on Main-st. was awarded to P. F. Connolly of Sioux Falls.

Saginaw, Mich.—The contract for paving Baum-st., from Tuscola to Johnson, was awarded to Z. & J. Lalondi for $2,104.60.

Luzerne, Minn.—Chapman & Boone secured the contract for constructing a cement walk at 12½ cts. a sq. ft.

Port Huron, Mich.—The contract for repairing Deeper-ave., from Seventh to Eighth, was awarded Oct. 20 to Henry G. Kaumeier.

Portsmouth, N. H.—The contract for constructing a state boulevard was awarded to A. J. Wellington of Boston, for $19,411.78.

Columbus, O.—Frank Fisher was awarded a contract for improving Nineteenth-st., from Long-st. to Mt. Vernon-ave., for $2,589.40.

Oakland, Cal.—The contract for macadamizing 2,078 ft. of road in Fitchburg was awarded to W. J. Schmidt, for $4,390.

St. Mary's, O.—The bid of Henry Gantz of Columbus, for paving Spring-st., using Athens block, for $14,799, will be accepted.

Cadillac, Mich.—Fred A. Powers was awarded the contract for grading, claying and graveling N. Shelby-st., from Pine to River-sts.

Swissvale, Pa.—The contract for 3,189 sq. yds. of paving on Denniston-ave. was awarded to McCready Bros. of Braddock, for $6,707.

Denver, Colo.—The contract for paving High and Race-sts. with disintegrated granite was awarded to the J. M. O'Rourke Construction Company.

Glenville, O.—The contract for macadamizing the Lake Shore boulevard, extending two miles, was awarded to Spence Bros., for $70,000.

Evansville, Ind.—Wm. Eichel secured the contract Oct. 21 for improving the road to Oak Hill cemetery with crushed stone and screenings.

awarded the contract for rebuilding the Union boulevard from Delevan to Fairmount-aves. for $11,000.

Columbus, O.—The Trinidad Asphalt Company, of Cleveland, was awarded the contract for repaving E. Town-st. with asphalt.

San Pedro, Cal.—The contract for 12,000 cu. yds. of grading in Fifth-st. was awarded to P. A. Howard, of Los Angeles, for $6,900.

Des Moines, Ia.—The contract for paving W. Eighth-st. with asphalt was awarded to the Capital City Brick and Pipe Company for $16,481.

St. Louis, Mo.—T. E. Cavanaugh has been

Johnstown, N. Y.—The contract for constructing a macadam road between Gloversville and Mayfield has been transferred to A. D. Norton of Gloversville.

Jersey City, N. J.—The Uvalde Asphalt Paving Company, of Jersey City, N. J., was awarded the contract for 4,000 sq. yds. of asphalt paving on Highland-ave.

Niagara Falls, N. Y.—The contract for paving First-st., from Falls-st. to Buffalo-ave., was awarded to the Barber Asphalt Paving Company Oct. 11 for $8,200.

Knox, Ind.—Folger & Co., of Columbus, Ind., were awarded the contract for building 13 miles of gravel road in Center twp. for $31,125.

Chester, Pa.—The Vulcanite Paving Company was awarded the contract Oct. 21 for paving Seventh-st. with asphalt on a 10-yr. guaranty at $2.24 a sq. yd.

Atlantic City, N. J.—MacAvoy & Cunningham of Philadelphia have been awarded a large contract for paving and repaving in certain streets for $121,902.

Schenectady, N. Y.—Paving contracts have been awarded as follows: Locust-ave., Schenectady Constructing Company, $3,955; Swan-st., Killam & Schaffer, $1,910.

Monongahela City, Pa.—The contract for brick paving, grading and curbing was awarded to R. T. Hallam & Sons of Washington at $1.39 a sq. yd., or $12,000.

San Francisco, Cal.—The contract for paving Folsom-st. with bitumen was awarded to the Union Paving and Construction Company for $6,754.98, according to press reports.

Southington, Conn.—The contract for building macadam roads from the borough line to S. Center School was awarded to B. D. Pearce, Jr., & Co. at 60 cents a sq. yd.

Crawfordsville, Ind.—D. B. Nelson was awarded the contract Oct. 21 for building a cement walk in front of the old jail property on Main-st. at 12½ cents a sq. ft.

Beloit, Wis.—The contract for constructing 65,000 ft. of cement walk and 1,500 lin. ft. of cement curb and gutter was awarded to Sullivan, Harris & Sullivan of Fond du Lac.

San Francisco, Cal.—Contracts for paving have been awarded as follows: Sacramento-st., $6,836; Front-st., J. J. Dowling, $13,172; California-st., City Street Improvement Company, $3,464.

Marshalltown, Ia.—The contract for constructing new walks was awarded Oct. 12 to Charles Buchwald at 7 cents a sq. ft. for vitrified paving brick and 10 and 11 cents for cement walks.

Boston, Mass.—Contracts for constructing state highways have been awarded as follows: Hatfield, $3,938, and Tewksbury, $4,273, to A. J. Wellington of Boston; Charlton, to Farranti & Maguire of Taunton, $16,472.

Boston, Mass.—Contracts for building sections of highways have been awarded as follows: Groton, A. J. Wallington of Boston, $4,864; Belchertown, Wm. Orlandon of Belchertown, $5,893; Cheshire, John W. Polcaro of East Boston, $1,698; Brienfield and Wales, Nicholas White of Medford, $5,982.

Petaluma, Cal.—(Special.)—N. S. Frost, cy. engr., says J. R. Nesbit has taken a private contract to macadamize a portion of Kentucky-st. at 4 cents a sq. ft., and to remacadamize portions of Sixth and Howard-sts. at an average price of 2 2-3 cents a sq. ft.

Albany, N. Y.—Paving contracts have been awarded as follows: Improving Riverside Park, John Dyer, jr., $25,822; brick paving in Sheridan-ave., Edward W. Dillon, $8,659; brick paving in Robin-st., Wm. H. Doyle, $6,573.

Cleveland, O.—Bids were received Oct. 16 for brick and asphalt paving on Detroit-st., from Higland-ave. to the Rocky River bridge in Lakewood hamlet, with 5-year guaranty, as follows: Ayers Asphalt Paving Co., $104,523; L. B. Stanley, $108,010; Cleveland Trinidad Paving Co., $99,925; Barber Asphalt Paving Co., $113,860.

Milwaukee, Wis.—The Western Paving & Supply Co. was awarded the contract for asphalt paving in Juneau-ave. at $2.35 a sq. yd., and John T. Hoff for brick paving on Juneau-ave., from Jackson to Van Buren, at $2.19 a sq. yd. The contract for cement walks around the Fourth ward park was awarded to W. P. Beckwith, at 14⅞ cts. a sq. ft.

Erie, Pa.—The councils have not yet awarded the contracts for repaving Peach-st. The contract was advertised in two sections. The Trinidad Paving Co. was the lowest bidder on brick, at $1.40 a sq. yd., and Henry Mayer was the lowest on asphalt at $1.59 a sq. yd. Failure to agree on the kind of material to use seems to have delayed the award.

Toronto, Ont.—Paving contracts have been awarded as follows: Constructing & Paving Co., asphalt paving in two streets, at $33,922; Barber Asphalt Co., asphalt paving in three streets, at $20,820; City Engineer, asphalt paving in one street, at $7,200; A. Chamberlin, brick paving in one street, at $2,399; J. H. McKnight, brick paving in two streets, at $4,100.

Buffalo, N. Y.—Bids were received Oct. 10 for paving Yale-place and repaving Krettner-st., from Broadway to Lovejoy. The bids were as follows: Yale-place—John Mumm, either kind of pavement, $3,950; Barber Asphalt Paving Co., $4,925; Interstate Paving Co., $2,065; German Rock Asphalt & Cement Co., $4,356; H. P. Burgard, $4,100; H. P. Burgard, round-edge fire clay brick, $4,150; H. P. Burgard, square-edge fire clay brick, $4,150; L. H. Gipp, round-edge fire clay or square-edge block brick, $4,050; L. H. Gipp, round-edge shale brick, $3,950; L. H. Gipp, square-edge shale brick, $3,900; George W. Partridge, round-edge repressed fire clay block brick, $4,135; American Contracting Co., asphalt, $4,625; Krettner-st., Broadway to Lovejoy, H. P. Burgard, Alcatraz, $2,100; H. P. Burgard, round-edge fire clay brick,

"B," $2,800; H. P. Burgard, square-edge fire clay brick "B," $2,800; American Contracting Co., asphalt, $2,738.75; German Rock Asphalt & Cement Co., $1,896.35; G. W Patridge, round-edge fire clay block brick, $3,146; Interstate Paving Co., $3,050; Barber Asphalt Paving Co., $2,253; John Mumm, with each kind of paving, $2,995.

SEWERS.

Buffalo, N. Y.—The sewerage system which is to take the place of the Hamburg canal will be completed in about four months.

Swedesboro, Pa.—The Swedesboro Sewer Company has elected Charles D. Lippincott president, William H. McCullough vice-president, William L. Moore secretary, John C. Rulon treasurer.

Creswell, Mich.—G. H. Hulbert & Co. of Port Huron have commenced work on the big town sewer. It will be 18-inch tile and will start about 200 feet east of the P. M. railroad tracks on Wells-st., thence west to Howard-ave., thence south to the town limits. The total length of the sewer will be 3,800 feet and it will cost $3,500.

Aiken, S. C.—Suit has been filed against this city by J. E. Harrigal and John Matheny for alleged damages caused by the overflowing of the sewage filter beds into Wise creek. They allege that the filthy sewage has been allowed to overflow into the creek, where they water their live stock on their dairy farms, thus injuring their business. They ask for $8,000.

Petaluma, Cal.—(Special.)—N. S. Frost, cy. engr., says that Contractor J. R. Nesbitt is laying under private contract 915 lin. ft. of 6-in. pipe sewer on Harvard-st. at 46 cents a lin. ft.; one manhole $25; one lamphole $10; average depth about 4 ft. This city is awaiting the decision of the supreme court regarding the validity of the new street law before commencing proceedings under it.

Crawfordsville, Ind.—Judge West of the circuit court sustained, Sept. 27, the demurrers to the complaint of the property owners on College and other streets against the construction of a sanitary sewer. Judge West held that the council had a right to order a sewer and a system of sewers; that his court had no jurisdiction to inquire into the motives of the council, and that a remonstrance to be effective must be signed by two-thirds of the property owners along the whole system.

Glencoe, Ill.—This suburb has adopted the Cameron septic sewer system. The plant was put in operation Oct. 2. The system is the discovery of Donald Cameron of Exeter, England, and Glencoe is said to be the first town in America to adopt the method. Health Commissioner Reynolds of Chicago thoroughly investigated the system during a trip to England, with a view to its application in Chicago under certain conditions.

CONTEMPLATED WORK.

North Adams, Mass.—A sewage disposal plant is contemplated.

Pekin, Ill.—Plans for a sewerage system are being considered.

Marshall, Mich.—A block of sewer on Mansion-st. has been authorized.

Utica, N. Y.—Sewers have been recommended for Scott and Ontario-sts.

Geneva, O.—The question of building a sewerage system is being considered.

Chatfield, Minn.—A sewerage system for this city is urged by the press.

Le Mars, Ia.—A resolution has been passed to issue $4,000 bonds for building sewers.

Racine, Wis.—About $10,000 will be expended for sewers in Kinzie-ave. Park addition.

Anoka, Minn.—Sewage filtration beds at the Anoka Asylum for the Insane are contemplated.

Toledo, O.—Surveys for a new sewer district are being made by Engineer Buell.

Everett, Mass.—The council voted to recommend the construction of a sewer in Belmont-st.

Portland, Or.—An ordinance was passed, Oct. 16, for a sewer on Hamilton-ave.

Topeka, Kas.—A 5-foot sewer from Crane and Jackson-sts. to the river is proposed.

Elizabeth, N. J.—An ordinance has been adopted for building a sewer in Fort-ave.

Mt. Vernon, N. Y.—Plans and specifications are being prepared for a sewage disposal plant.

Duluth, Minn.—A sewer in Nineteenth-ave., E. between Fourth and South-sts., is proposed.

Allegheny, Pa.—Ordinances have been passed for constructing sewers on a number of streets.

Hartford, Conn.—A sewer on Zion-st., between Harbison-ave. and Hamilton-st., is contemplated.

Atlanta, Ga.—A resolution has been passed for a sewer on Poplar-st. W. J. Campbell, cy. clk.

Perth Amboy, N. J.—Resolutions have been adopted for sewers in State and Rector-sts.

Dubuque, Ia.—City Engineer Blake is preparing plans for the construction of the Eagle Point sewer.

Montgomery, Ala.—The city engineer has been directed to build storm water sewers in two streets.

Chester, Pa.—The construction of a sewer on Conrad-ave. is contemplated. Frank W. Harrison, cy clk.

Lansing, Mich.—Bids for 430 ft. of 6-in. sewer in Cedar-st. will be received. C. J. McCulloch, cy. clk.

Albion, N. Y.—This city is considering the system of the International Sewage Disposal Company of Boston.

Pasadena, Cal.—Resolutions were adopted Oct. 15 for sewers on Villa-st. and S. Fair Oaks-ave.

Niagara Falls, N. Y.—An expenditure of $115,000 for new sewers is contemplated, according to press reports.

Springfield, Ill.—The park board voted to build an 18-in. sewer with catch basin appliances in the new boulevard.

Cleveland, O.—Bids will be asked soon for repairing the Marquette-st. sewer. Chas. P. Salen, dir. pub. wks.

Hutchinson, Kas.—Plans for a sewerage system will be secured by the council, according to press reports.

Ashley, Pa.—An ordinance has been approved for the extension, construction and

maintenance of a sewerage system in this town.

Whitinsville, Mass.—A survey will be made of this town with a view to securing a means of sewage disposal.

Pomona, Cal.—A resolution has been passed providing for the construction of sewers. S. C. Slanker, st. supt.

St. Joseph, Mich.—The construction of sewers in Wisconsin and Niles-aves. is contemplated. L. D. Townsend, cy. clk.

Columbia, S. C.—J. L. Ludlow of Winston N. C., has been engaged to make survey and plans for a sewerage system for this place.

Atlantic City, N. J.—The sewerage system of this city is inadequate to the demands upon it, according to press reports.

Ft. Dodge, Ia.—Bids will probably be asked about Nov. 11 for 1,450 ft. of 12-in. sewer, 12 catchbasins and 4 manholes. C. H. Reynolds, cy. engr.

Milwaukee, Wis.—Bids will be asked for completing section No. 2 of the Kinnickinnic flushing tunnel, which was abandoned by the contractors.

The construction of sewerage systems is contemplated at the following places: Wasson, Minn.; Boone, Ark.; Dell Rapids, S. D.

Madison, N. J.—This city has decided to install the International system of sewage disposal, at a cost of about $75,000.

Topeka, Kan.—City Engineer McCabe is preparing plans for the new sewer district bounded by Lincoln, West, Fifth and Sixth-sts.

St. Joseph, Mo.—The ordinance for the Blacksnake sewer has been passed. Also ordinances for sewers in districts Nos. 51 and 67.

McKeesport, Pa.—Plans are being considered for the construction of sewers to carry the water off Crooked Run in the east end.

Houston, Tex.—Plans and specifications for a sewer in Capitol-ave., from Main to Louisiana, have been prepared by I. Austin Miller, cy. engr.

Danielson, Conn.—The Attawaugan Mfg. Company will construct a system of sewers for its villages, Attawaugan and Ballouville, according to press reports.

Monmouth, Ill.—Petitions are being circulated for the establishment of a sewer district for the southeastern part of the city. Cy. Engr. McClanahan.

New Bedford, Mass.—In his annual report, W. H. Richardson, engr. of the sewer department, recommends that preliminary surveys and plans be made this winter for the northern part of the city.

Martinsville, Va.—Sewers amounting to $5,500 are to be constructed under the supervision of the city engineer, the work to be done by the city. J. R. Gregory, cy. engr.

The question of issuing bonds for sewerage systems will be voted on as follows: Lewiston, Mont.; Fairmount, W. Va.; Healdsburg, Cal., Livingston, Mont., Nov. 12; Wilmont, Minn.; Bethlehem, Pa.

Saratoga Springs, N. Y.—The state board of health has ordered the construction of a sewage disposal plant. Plans have been submitted by Snow & Barbour of Boston.

Moline, Ill.—A quarter of a mile of 7 ft. sectional tile sewer will be constructed in the tailrace by the D. R. I. & N. W. railroad company at an approximate cost of $30,000.

Chicago, Ill.—Plans for sewerage facilities for South Chicago are being considered and Nov. 1 has been set as the date for a final decision. The estimated cost is from $700,000 to $800,000.

North Billerica, Mass.—Plans for the construction of a sewerage system to be owned by the Talbot Mills, but to cover the entire village, are being considered. Frederick S. Clark, treas. Talbot Mills.

Forest City, Pa.—The Forest City Sewerage and Drainage Company will apply for a charter to install a sewerage system here. H. T. Aldrich, J. J. Walker, J. F. Wellbrock and others are the incorporators.

Galt, Ont.—The property-owners have petitioned for the extension of the sewerage system on N. Water-st., from Dickson to North, thence along North to Wellington, and on Ainslie-st., from North to Dickson.

Charlotte, Mich.—Messrs. Albert Murray, Chas. Lamb, O. E. Packard, Jerrie Mikesell and L. H. McCall have been appointed a committee to investigate the feasibility of route, outlet, plans and best system of sewerage for this city. Murl H. DeFoe, cy. clk.

The question of issuing bonds for sewerage system has been favorably voted on at the following places: Charlotte, Mich., $30,000; New Hartford, N. Y., $20,000; Aitken, Minn.; Liberty N. Y., $10,000; Louisburg, N. C., $30,000; Richmond, Cal., $8,000; Gladwin, Mich., $3,000.

Newport, Ky.—A joint resolution was adopted Oct. 17 directing the city engineer to ask for bids for the entire sewerage system in that part of the city east of Park-ave. Bids will also be asked for that part of the system between Sixth-st. and the Ohio river.

Morristown, N. J.—Lonzella & Tighe of East Orange, who secured the contract in July for a sewerage system for this place, have abandoned the contract after doing about $10,000 worth of work. The township committee will readvertise for bids for the completion of the work.

Chicago, Ill.—The contract for completing the Lawrence-ave. sewer will be readvertised. The contract was awarded to Failey & Green in April, 1898, who abandoned it. The machinery the contractors put in for tunneling work failed to do what was claimed for it, so that of over 9,000 ft. of this kind of work only 729 ft. has been done.

CONTRACTS TO BE LET.

Youngstown, O.—Sealed bids are asked until 12 m. Nov. 9 for a sewer on Burke-st. C. E. Cross, clk.

Larchmont, N. Y.—Sealed bids are asked until Nov. 4 for constructing an outlet sewer. L. S. Knevals, vil. clk.

Canton, O.—Bids are asked until Nov. 2 for building sewers in several streets. C. C. Lloyd, cy. clk.

Toledo, O.—Sealed bids are asked until 12 m. Nov. 4 for brick and pipe sewers in three streets. J. E. Connell, cy. clk.

Rushville, Ind.—Sealed bids are asked until 7:30 p. m. for constructing a drain. John Rutledge, cy. clk.

Marshall, Mo.—Bids are asked until Nov. 4 for a district sewer, with manholes, flush tanks, etc. A. R. James, cy. clk.

Burlington, Ia.—Sealed bids are asked until 4 p. m. Nov. 4 for constructing the main Hawkeye sewer. Emmet Steece, cy. engr.

St. Paul, Minn.—Sealed bids are asked until 2 p. m. Nov. 4 for a sewer on Winifred-st. and Stryker-ave. C. H. Bronson, clk. B. P. W.

Mapleton, Minn.—Sealed bids are asked until Nov. 4 for 3,434 feet of sewer on Main, Second and Church-sts. C. J. Laurisch, vil. rec.

Hudson, N. Y.—Bids are asked until Nov. 8 for a sewage disposal plant at the House of Refuge for Women. Herbert E. Mills, prest. bd. mgrs.

Washington, D. C.—Sealed bids are asked until 12 m. Nov. 2 for constructing sewers in the District of Columbia. H. B. F. MacFarland, chmn. dist. comrs.

Roswell, N. Mex.—Sealed bids are asked until 3 p. m. Nov. 16 for constructing a pipe sewer with flushing water supply and drainage system. Samuel Atkinson, town clk.

Le Sueur Centre, Minn.—The contracts for constructing ditch No. 17, in town of Cordova, will be sold Nov. 12 and ditch No. 18, in town of Montgomery, Nov. 13. Co. Recdr.

Green Bay, Wis.—Sealed bids are asked until 12 m. Nov. 2 for constructing 24, 20, 18, 15, 12, 10 and 8-inch pipe sewers in eighteen streets. George J. Schwartz, chamn. com. on sewers.

Glenville, O.—Sealed bids are asked until 12 m. Nov. 4 for a sewer, with flush tank, manholes and other appurtenances in St. Clair-st., from Houghton-ave. to Bratenahl road. Ira C. Farley, vil. clk.

Milan, Ill.—Bids are asked until Nov. 5 for furnishing and delivering 26,275 ft. of 12, 15, 16, 18, 24 and 26-inch tile necessary for the completion of the drains in said district. Geo. V. Loring, dist. engr., Decatur.

CONTRACTS AWARDED.

Owatonna, Minn.—J. A. Soper was awarded the contract for the Elm-Prospect-st. sewer.

St. Paul, Minn.—W. J. Preston was awarded the contract for a sewer on Thomas-st.

Oakland, Cal.—Michael Murphy was awarded the contract for building sewers in four streets.

Oshkosh, Wis.—The contract for a sewer in Minnesota-st. was awarded to J. Rasmussen & Son.

Pasadena, Cal.—S. J. Edwards was awarded a contract Oct. 15 for a sewer in Grant-st. for $515.

St. Paul, Minn.—P. H. Thornton was awarded the contract for a sewer on Whitall-st., for $4,799.

St. Louis, Mo.—The contract for a sewer in Filmore district was let to H. Rueckling & Co., for $121,966.

Buffalo, N. Y.—Thomas McKeown was the lowest bidder for a sewer on Mumford and Cumberland-sts., at $9,919.

Carthage, Mo.—The contract for a sewerage system in dist. No. 3 was awarded to W. W. Cook & Son for about $9,000.

Swedesboro, N. J.—The contract for building a sewerage system for the Swedesboro Co., was awarded to B. F. Sweeten & Son of Camden.

Xenia, O.—The contract for sewers in sewer dist. No. 1 was awarded Oct. 17 to A. F. Shover of Indianapolis, for $30,813.

Gloucester City, N. J.—The contract for 1,600 ft. of sewers was awarded to Frank H. Burt of Camden, at $1.65 a lin. ft.

Farmer City, Ill.—Messrs. I. F. Houseman, James Jackson and J. H. Smith have been granted a franchise for constructing a sewer.

De Pere, Wis.—John Pauwels was awarded the contract for constructing branch sewers in certain alleys at 33 cts. a lin. ft.

Fond du Lac, Wis.—The contract for erecting a pumping station for the septic sewerage system has been awarded to Blake Bros., of Madison, for $1,550.

Beresford, S. D.—The contract for constructing 3,700 feet of main sewer has been awarded to the Mankato Heating and Plumbing Company for $4,600.

Washington, D. C.—The contract for a sewer in New Jersey-ave., S. E., between F and N-sts., was awarded to E. G. Gummel for $42,365.

Milwaukee, Wis.—Jas. O'Donnell was awarded the contract for building section 8 of the Thirtieth-st. sewer tunnel, at $25.50 a ft. or $40,545 for the whole.

Columbus, O.—The contract for constructing sewers in Peters and Gill alleys was awarded, Oct. 11, to Jacob Lind, for $358.26 and $469.75 respectively.

St. Joseph, Mo.—Rackliffe & Gibson secured the contract for building the Twenty-fourth-st. sewer, at $3.30 a running foot for brick, or $4,000 for the whole.

Swissvale, Pa.—The contract for constructing a joint sewer for Swissvale and Rankin was awarded to D. V. Ault & Co., for $5,257 and for Rankin, Swissvale and Braddock for $23,857.

Rochester, Pa.—Whitmore, Rauber & Vicinus secured the contract for the Sawyer-st. sewer for $6,518.15, and James Kearnes the contract for Lisbon-st. at $262.

Jackson, Mich.—T. C. Brooke & Son of this city secured the contract for the Trail-st. sewer extensions at $4.50 a lin. ft., $30.00 each for manholes and $28.00 each for catch basins.

Kansas City, Mo.—The Robert J. Boyd Construction company, was awarded the contract for the Wesport sewer for $62,847 and W. C. Mullins the contract for the Gooseneck sewer for $87,951.

Conneaut, O.—Bids were received Oct. 8 for building sewers in dist. Nos. 3 and 4, the total bids for the work being as follows: McMahon & Son, Toledo, $26,277.50; V. D. Eichenlaub, Erie, Pa., $33,814.75.

Lockport, N. Y.—The contract for building sewers in Lock-st. and Richmond-ave. was awarded to C. N. Stainthorpe & Co., for $13,999; sewers and water pipes in Irving-st., C. N. Stainthorpe & Co., $4,000; sewer and water pipe in W. High-st., F. J. Le Valley, $1,398.

Port Huron, Mich.—Christie Walters was awarded the contract, Oct. 14, for a sewer in the alley of block 48 and Division-st., and a 10-in. tile sewer in alley of block 6. Thos. Finane was awarded the contract for an 8-in. tile sewer in Minnie-st., and a 12-in. tile sewer in an alley.

Havana, Cuba—Bids were received Oct. 23, according to press reports, for sewering and paving in this city as follows: Pan-American Construction Co., of West Virginia, represented by Michael J. Dady, of Brooklyn, N. Y., and C. A. Palmer, $11,485,896. McArthur Co., of New Jersey, $11,480,964; Havana Construction Co., represented by John McLellan, $11,214,506; S. P. McGivney and R. T. Rokeby, of Jersey City, $10,393,616.

WATER-WORKS.

Erie, Pa.—An inspection will be made of the water pipes laid in this city for electrolysis.

Portage, Wis.—This city took possession of the water works plant Oct. 2, having purchased it for $42,500.

San Saba, Tex.—N. T. Richmond, of St. Louis, Mo., has purchased the water works system of this city.

Syracuse, N. Y.—The underground pipes of this city are in danger of serious damage by electrolysis.

Washington, D. C.—The total length of new water mains laid during the year was 65,812 ft., or about 12½ miles.

Hutchinson, Kas.—The Commercial club is agitating the question of this city purchasing the water works and light plant.

Appleton, Wis.—This city will not accept the offer of the water company, which proposes to sell the plant for $315,000 or to rent it for 20 yrs. at the rate of $13,000 per year.

Mineral Wells, Tex.—The proposition to sell the water works plant, together with the franchise for $2,000 and some real estate of about $300 value, was defeated in the special election held Oct. 16.

LaSalle, Ill.—The Peru Plow and Wheel Works closed down Oct. 5 owing to the city shutting off its water supply. The company refused to comply with the order of the city council to use a water meter.

Cleveland, Tenn.—The U. S. court of appeals has decided against the water company in the suit of the Cleveland Water and Light Company vs. the city of Cleveland. A full report of the decision has not yet been received.

Paris, France—The latest plant for a pure water supply for this city is to utilize the waters of the Loire, the water to be drawn from the Lac des Saules, in the department of the Aroche, 60 miles from the source of the Loire.

Washington, D. C.—A thorough study of the water supply system of the District of Columbia, and particularly the construction of the Aqueduct tunnel and the new reservoir at Howard University, will be made by Capt. Thos. H. Rees, Corps of Engineers.

Terre Haute, Ind.—The Terre Haute Water Works Company is constructing a settling basin 230 ft. long and 66 ft. wide. When not needed for sedimentation purposes the basin can be used as a clear water reservoir for the effluent from the filters.

Louisville, Ky.—A committee of two experts will be appointed to examine the condition of the books of the water company and the workings of the concern and make a complete report to the council. The sum of $1,000 has been voted to pay for the investigation.

Wheeling, W. Va.—Arguments were heard Oct. 17 by Judge H. C. Hervey upon application of the citizens of Chester, W. Va., for an injunction to restrain the town council from granting a franchise to the water works company. The company has constructed its plant and partially laid its mains.

Martinsburg, W. Va.—Judge Jackson rendered a decision Oct. 19 in the case of the Harpers Ferry Paper Company vs. Joseph E. Thorp, in which he perpetuates the temporary injunction issued Jan. 24, 1901, for polluting the waters of the Potomac river by dumping the wash water from the Virginia-ave. bank into the river.

East Liverpool, O.—A large reservoir, containing 10,000,000 gals. of water bursted Oct. 13, causing great damage. The reservoir was only completed a few days before and was filled for the first time the morning it bursted. The basin is located 500 ft. above the pumping station on the highest hill in the city. The loss is estimated at $100,000 to $125,000.

Oshkosh, Wis.—A petition was filed in the circuit court Oct. 19 asking for the removal of W. G. Moxey as receiver of the Oshkosh Water Works Company, and charging him with having wrecked the company and of misappropriation and misapplying its funds. It is alleged that he has held meetings all by himself and voted himself dividends when the money should have been used in making necessary improvements and paying interest on the mortgage bonds of the company.

Bowling Green, O.—Frank Graff has begun action in the United States court at Toledo against the Bowling Green Water Company to set aside proceedings assuming to authorize the sale of the water plant to Mary G. Lambert, and asking for the appointment of a receiver and a master commissioner to take an accounting of the company's business transactions since 1894. Since the purchase of the water plant Mrs. Lambert has died and the property has passed into the hands of heirs.

CONTEMPLATED WORK.

Wheeling, W. Va.—The water mains will be extended.

Eureka, Ill.—The extension of the water mains is proposed.

Beloit, Wis.—The extension of the water mains is contemplated.

New Richland, Minn.—A water works system is urged by the press.

Sheboygan, Wis.—Plans for a new water works plant have been accepted.

Centerville, S. D.—The extension of water mains is proposed. W. W. com.

Hyattsville, Md.—The construction of a water main on Block-st. is proposed.

Monson, Mass.—The water works system is to be extended on N. Main-st. and Stewart-ave.

Coon Rapids, Ia.—The construction of more mains is proposed. M. M. Cooney.

Whitewright, Tex.—The issue of $6,500 for water works bonds have been approved.

Manhattan, Kans.—The extension of water mains on Loraine and Second-sts. is proposed.

Salt Lake City, Utah.—Water mains are

contemplated on Eleventh, E. Blaine and Wilson-aves.

Bloomington, Ind.—The water mains will be extended to E. Fourth, W. First and E. Tenth-sts.

Sioux Falls, S. D.—The question of issuing bonds for a municipal water plant will be voted on.

North Chicago, Ill.—This village contemplates laying 2 miles of water mains at a cost of about $10,000.

Cripple Creek, Colo.—The water mains will be extended about 3½ miles with about 20 hydrants.

Bay City, Mich.—This city has voted to issue bond for $25,000 for extending the water mains. Mayor Lind.

Bloomington, Ill.—A water main will be constructed on Emerson-st. A reserve water supply is proposed.

Madison, Minn.—Plans are being prepared for a water works system, to be installed in the spring.

Hamilton, Mont.—The Canyon Creek Reservoir Company has been incoporated to supply water to the public.

Appleton, Wis.—The water works committee refused to purchase the present system and will construct one.

Howell, Ind.—The question of piping water from Evansville to this city is being considered. Bd. trustees.

Paxton, Ill.—Ordinances have been passed for laying water mains in several streets. D. C. Swanson, cy. clk.

Conneaut, O.—The intake pipe will be extended 750 ft. into the lake in order to secure a better water supply.

St. Louis, Mo.—Plans are being suggested for utilizing Creve Coeur Lake as a source of the city's water supply.

South Haven, Mich.—A resolution has been passed to construct a 4-in. water main on Lyon-st. A. Ryall, vil. clk.

Los Angeles, Cal.—The extension of the water main to Forty-seventh-st. on Central-ave. has been petitioned for.

Tacoma, Wash.—The city engineer recommends the extension of the water mains to South Tacoma, at a cost of $12,300.

Wellington, Kas.—The city council is considering the question of wells, reservoirs and another dam for the water works.

Wichita, Kas.—The Wichita Water Company will expend $50,000 in improvements before next spring. Fred Aley, supt.

Gadsden, Ala.—The citizens of this city have petitioned the city council to issue bonds for a new water works system.

St. Cloud, Minn.—A new water works system will be installed at the St. Cloud reformatory, 2 miles from the city.

Pennsgrove, Pa.—A committee has been appointed to investigate the feasibility of the borough having its own water works plant.

Ft. Leavenworth, Tex.—A preliminary survey and estimates are being made for a power house and supply reservoir for this city.

Akron, O.—The Akron Water Works Company has purchased 43 acres of land near Summit Lake, and will sink wells for a water supply.

Barberton, O.—The water works trustees were authorized, Oct. 7, to secure estimates of the cost of sinking test wells for new water works.

Houghton, Mich.—The question of building a pumping station in connection with the water works system is contemplated.

Walhalla, S. C.—Bids will be asked in January for constructing water works. J. W. Shelbo, prest. Blue Ridge Water Co.

Champaign, Ill.—The Champaign Water Company contemplates sinking a new well, adding two new pumps and extending the mains next year.

Woodbury, N. J.—The water committee was instructed, Oct. 15, to prepare specifications for a pump for the water works. Chairman Best.

Winona, Minn.—The city engineer has been authorized to prepare plans and specifications for laying water mains on certain streets.

Columbus, O.—Several additional wells will be sunk at the east side pumping station to increase the underground water supply.

Ashfield, Mass.—A gravity system, with Taylor Brook as its source, has been recommended for Ashfield Plain, by E. C. and E. E. Davis.

Merchantville, N. J.—Isaac Ferris, Jr., and other residents of this place are at the head of a project to build a new water plant.

Meadville, Pa.—The purchase of a new pump of 4,000,000 gallons per day has been authorized. Definite option on lands to be used for water purposes will be secured.

Lewiston, Idaho.—(Special)—The question of issuing $80,000 new water works bonds will be voted on Nov. 19. The plans were prepared by Ernst McCullough, cy. engr.

Minneapolis, Minn.—J. H. McConnell, supervisor of the water works department, estimates that it will cost $1,256,146 to secure pure water for this city.

Moline, Ill.—A new contract has been made with D. W. Mead, who is preparing plans and specifications and will supervise the construction of a water filter system.

Petaluma, Cal.—(Special)—N. S. Frost, city engineer, says a committee of the board of trustees is investigating the advisability of municipal ownership of the water and electric plants.

Charleston, Ill.—An issue of $5,000 bonds for the purchase of two boilers, one hot water pump and 2,000 ft. of 4-in. pipe for the water works system has been authorized.

Madison, Neb.—Plans and specifications for the new steel standpipe and extension of the water mains will be made by Arnold C. Koenig, C. E., of Grand Island, Neb. Clyde G. Ryncarson, clk.

Washington, D. C.—Plans for a pumping station to be erected at the Bryan's Point Station of the fish commission, for the purpose of pumping water from the Potomac into the fish tanks and hatching tables at the station have been completed.

The question of issuing bonds for water works will be voted on at the following places: Baraboo, Wis., Nov. 5; Muskegon Hights, Mich.; Newell, Ia., Nov. 4; Wellington, Kas., Nov. 7; West Milton, O.; Lewiston, Mont., Nov. 12; Georgetown, Del.; Marshall, Mo.; Hartford, S. D.; Livingston, Mont., Nov. 12.

Terre Haute, Ind.—The expenditure of $500, appropriated by the county council to

bore for water to test the supply for a water works plant, is objected to, and it is probable that the question of municipal works will be deferred owing to the fact that the city has nearly reached the constitutional limit.

The question of issuing bonds for water works construction was favorably voted on at the following places: Woodmere, Mich.; Primghar, Ia.; Ryan, Ia.; Terry, Miss.; Loudonville, O.; Southampton, Ont.; Alfred, N. Y.; Nampa, Idaho; Brookville, O.; Lemoore, Cal.; Valley Springs, S. D.; Tempe, Ariz.; Houma, La.; Forest, Miss.

The construction of water works systems is contemplated at the following places: West Milton, O.; Jasper, Ala.; Avon, S. D.; Pemberville, O.; Colchester, Ill.; Otterbein, Ind.; Wabasso, Minn.; Florence, S. C.; Riovista, Cal.; Bloomfield, Ind.; Durango, Mex.; Albany, Minn.; Kaufman, Tex.; Arthur, Ill.; Cambridge, Ia.; Boone, Ark.; Gillett, Wis.; Milan, Minn.

CONTRACTS TO BE LET.

Afton, Ia.—Bids are asked until 8 p. m. Nov. 4 for erecting a windmill over the city well. Town Coun.

Clarinda, Ia.—Bids are asked until Nov. 5 for constructing a 20x60 ft. standpipe. C. W. Foster, mayor.

Cambridge, Minn.—Bids are asked until Nov. 12 for $11,500 water works bonds. A. H. Southerland, pres't vil. coun.

Topeka, Kas.—Bids are asked until Nov. 6 for erecting a water tower for the Topeka State Hospital. Edwin Snyder, sec'y bd. trustees.

Scammon, Kas.—Bids are asked until Nov. 20 for constructing a water works system. Rob't Gilmore, mayor; John G. McLaughlin, cy. clk.

Winona, Minn.—Bids are asked until 8 p. m. Nov. 4 for fitting two boilers at the pumping station with new fire grates. Paul Kemp, cy. recdr.

Plymouth, O.—Bids are asked until Nov. 2 for constructing water works, including a standpipe, filter plant, reservoir, pumping plant. J. I. Beilman, clk.

Raymond, Minn.—Sealed bids are asked until 8 p. m. Nov. 4 for drilling one 8-in. well about 150 ft. in depth. M. A. Scholz, pres't coun.

Kirkwood, Mo.—Bids are asked until Nov. 9 for furnishing this city with a water supply, to be taken from the Missouri or Meramec rivers. J. G. Hawken, cy. clk.

Jacksonville, Fla.—Bids are asked until Nov. 15 for the purchase of $400,000 5 per cent. gold bonds for water works and other improvements. B. F. Dillon, chmn.

Meadville, Pa.—Sealed bids are asked until 8 p. m. Nov. 20 for furnishing and erecting a water pumping plant, to consist of one steam pump and two boilers. A. C. Pardee, cy. clk.

Pentwater, Mich.—Sealed bids are asked until 5 p. m. Nov. 5 for taking up well-points now on Hancock-st. and putting them on Third-st., between Hancock and Carroll-sts. Daniel J. Halstead, vil. clk.

Cincinnati, O.—Bids are asked until Nov. 15 for furnishing a 100 H. P. steam boiler of 150 lbs. pressure and the necessary adjuncts for the new works near California. Aug. Hermann, pres't bd. trustees.

Phoenixville, Pa.—Bids are asked until Nov. 4 for constructing a 10,000,000 gal. sedimentation reservoir near this city. J. W. Ledoux, ch. engr., American Pipe Mfg. Company, 112 N. Broad-st., Philadelphia.

New York City—Bids are asked until Nov. 7 for furnishing double nozzle case hydrants, lead lined iron pipe, union, etc., water main and a 48-in. main in Van Cortland Park, etc. Dept. Water Sup., 21 Park Row.

Grand Rapids, Mich.—Sealed bids are asked until 2 p. m. Nov. 12 for furnishing this city with a pure and wholesome water supply from any desirable source, comprising a complete plant, consisting of intake and delivery, etc. L. N. Anderson, cy. engr.; Chas. A. Hague, cons. engr.

CONTRACTS AWARDED.

Uniontown, Pa.—Isaac W. Semans and associates have been granted a water works franchise.

Osseola, Ia.—A franchise for building a water works system has been granted to W. M. Peatman of Centerville, Ia.

Wickliffe, Ky.—Ed Burke of Cario, Ill., was awarded the contract for building a water works system in this city.

Normal, Ill.—The contract for the 6-in. cast iron water main was awarded to Wolf, Maupin & Curdle of Alton, Ill., for $1,415.

Blairsville, Pa.—The contract for laying water mains from the reservoir was awarded to Frank A. Brancate, at 37½ cents a ft.

Geneva, O.—The contract for a filter plant was awarded to the New York Continental and Jewel Filter Company of New York city for $3,850.

Lind, Wash.—An exclusive franchise has been granted Neilson Bros. of this town for 25 years, to lay water mains and operate a water works system.

Webster, N. D.—The contract for a water works and electric light plant was awarded to the Allan Black Company of St. Paul for $18,544.

Newark, N. J.—Wright & Linkley of Orange, N. J., secured the contract, Oct. 17, for constructing an outlet tunnel for Cedar Grove reservoir, in Verona and Montclair for $4,854.

Denison, Tex.—The Denison City Water Company has been granted a 20-yr. extension of its franchise and a contract to furnish the city with water at a cost of $7,925.

Springfield, O.—The lowest bid submitted Oct. 16, for the construction of a supplemental water supply system for this city was submitted by Ulrick & Williams of this city for $53,436.

BRIDGES.

Northeast Harbor, Me.—A steel bridge is contemplated.

Wichita, Kas.—A new bridge across the Salt Fork is contemplated.

New Castle, Pa.—The erection of an iron viaduct is urged by the press.

Princeton, Ind.—Bids are asked until Nov. 5 for 8 steel bridges. S. H. Adams, co. audt.

Kansas City, Mo.—An ordinance has passed both houses for constructing the Allen-ave. viaduct.

Dover, Tenn.—This county has voted to build a bridge over Elk creek and one over Cross creek.

Perth Amboy, N. J.—A bridge across the Raritan to connect Perth Amboy and South Amboy is contemplated.

Topeka, Kas.—The question of building a fifth Kaw iron bridge will be voted on in November.

Towson, Md.—The construction of a bridge between Baltimore and Hartford counties is contemplated.

Victoria, B. C.—Bids are asked until Nov. 11 for constructing a steel bridge. C. H. Topp, cy. engr.

Hutchinson, Minn.—A new steel bridge over Crow river, at the east end of Second-ave., is proposed.

Shelbyville, Tenn.—The bridge committee has decided to build three steel bridges across Duck river.

Savannah, Mo.—Bids are asked until Nov. 4 for building four bridges in Andrew county. J. E. Schmitzins.

Quincy, Ill.—Preliminary drawings for a viaduct over York-st. are being prepared by City Engineer Hitchcock.

Saginaw, Mich.—Bids will be received until Dec. 12 for a bridge at Genesee-ave. Hiram E. Terry, cy. engr.

Los Angeles, Cal.—The board of supervisors has decided to ask for bids for a bridge over Los Pueblos creek.

Bath, N. Y.—The question of constructing an iron bridge across the Canisteo river will be voted on.

Fowler, Ind.—Sealed bids are asked until 1 p. m. Nov. 6 for building 13 bridges. Ben Davidson, chmn. co. comrs.

Vicksburg, Miss.—Bids are asked until Nov. 4 for repairing Hawkinson ferry bridge. J. D. Laughlin, clk. bd. co. supvrs.

Wilkesbarre, Pa.—Bids are asked until Nov. 7 for repairing South-st. bridge. D. W. Jones, chmn. joint st. com.

St. Joseph, Mich.—Plans for a swing bridge across Morrison channel will be prepared by Wm. H. Cleary, cy. engr.

Kentland, Ind.—Bids are asked until Nov. 4 for building an iron bridge across the Iroquois river. S. C. Jones, co. audt.

Helena, Mont.—The residents of Beartooth and Craig have petitioned for a bridge across the Missouri river.

Portland, Mich.—The question of issuing bonds for a new bridge over Grand river will be voted on in the spring.

Westmoreland, Kas.—Bids are asked until Nov. 9 for building a steel bridge over Cross creek. A. P. Scritchfield.

Elizabeth, N. J.—This city has decided to build new iron bridges across Elizabeth river at Crane and Prince-sts.

Lake Charles, La.—Bids are asked until Nov. 16 for building a bridge across Beckwith creek. J. O. Stewart ,police juryman.

Sherbrooke, Quebec—Bids are asked until Nov. 12 for the superstructure of a riveted steel highway bridge. J. F. Griffin, secy.-treas.

Los Angeles, Cal.—The board of supervisors contemplates building a bridge across the San Gabriel river, near Duarte and Azuza.

Delphi, Ind.—Bids are asked until Nov. 4 for constructing two bridges and three arch culverts in Carroll county. Jas C. Smock, co. audt.

Merrill, Wis.—A recommendation of the board of public works to appropriate $6,000 for a new bridge across Prairie river at First-st., has been adopted.

Ludlow, Mo.—Bids are asked until Nov. 6 for a steel bridge over the Shoal creek, 1½ miles south of this city. J. Y. Powell, bridge com'r.

Edwardsville, N. Y.—The Black Lake Bridge Company has been formed in this city to build a bridge across Black Lake between Morristown and Macomb. Elery Colby, prest.

Jackson, Mo.—Sealed bids are asked until Nov. 4 for building a steel bridge with stone pillars across Hubble creek, near Jackson. B. A. Daugherty, road and br. com'r.

Edina, Mo.—Bids are asked until Nov. 8 for erecting a bridge over Muddy Fork, in Shelton twp., and until Nov. 9 for a bridge across Bridge creek in Queensburg twp.

Fort Collins, Col.—Sealed bids are asked until 10 a. m. Nov. 4 for constructing a combination bridge across Fossil creek on College-ave. road, near McClelland's. H. E. Tedmon, co. clk.

Beloit, Kas.—The question of making an appropriation for building a bridge across the North fork of the Solomon river will be considered Jan. 6, 1902, by the Mitchell county commissioners.

Kingfisher, O. T.—Sealed bids are asked until 4 p. m. Nov. 2 for flooring the Gould bridge over the Cimaron river and for building four steel and three wooden pile bridges. J. E. Burns, co. clk.

Buffalo, N. Y.—Bids are asked until Nov. 4 for the substructure and superstructure of the subway under the Western New York and Penn. R. R. in Fillmore-ave. E. B. Guthrie, ch. engr. grade crossing com'rs.

Columbus, Ga.—(Special.)—Robert D. Johnson, supt. B. P. W., says an election was held on Oct. 10, on the issue of $40,000 of 4 per cent. 10-year bonds for the purpose of building a new steel bridge over the Chattahoochee river, to replace the old wooden bridge at Fourteenth-st. The result was favorable for the bond issue. Mr. L. H. Chappell, mayor, will doubtless be chairman of a special committee for looking after the new bridge.

STREET LIGHTING.

Frenchtown, N. J.—A franchise has been granted the Frenchtown Gas Company.

Mansfield, Mass.—This town has voted to establish a municipal electric light plant.

Denver, Col.—A 20-year franchise has been granted the Denver Steam Heating Company.

Genoa, Ill.—A franchise for an electric light plant has been granted Fred A. Aldan of Sycamore.

Newport, Me.—Plans to light this city with gas are being made by the Smith-Sturtevant Company.

Montpelier, Vt.—The organization of a new gas company is being planned, according to press reports.

Ridgeway, O.—The council contemplates lighting the streets with arc lamps, according to press reports.

Winnipeg, Man.—Estimates of the cost of a municipal gas plant are being prepared by Com'r Stuart.

Petoskey, Mich.—A 30-year franchise has been granted M. Earl Brackett and others for a gas plant.

Louisville, Ga.—The cost of an electric light plant is being investigated by the Louisville Mfg. Company.

Skaneateles, N. Y.—The question of raising $10,000 for increasing the electric light plant will be voted on Nov. 1.

Houston, Tex.—The Citizens' Electric Company will expend about $150,000 in improvements. W. W. Chapman, mgr.

Sandusky, O.—A franchise has been granted to the Merchants' Electric Light Company for a heating plant for $75,000.

Auburn, N. Y.—The franchise of the Citizens' Heat, Light and Power Company, which was revoked last summer, was renewed Oct. 7.

Whittier, Cal.—The City Trustees decided, Oct. 15, to ask for bids for granting a franchise for electric power and lights.

Port Leydon, N. Y.—Plans for an electric light plant for this city are being prepared by the Westinghouse Electrical Company.

The question of issuing electric light bonds has been favorably voted on as follows: Caldwell, O.; Booneville, N. Y.

Sault Ste. Marie, Mich.—A franchise for constructing and maintaining a gas plant has been applied for by Chas. P. Locke and Thos. Blain.

Helena, Mont.—Application has been made to the United States court for the appointment of a receiver for the Helena Power and Light Company.

Rochester, Minn.—This city has voted to issue $25,000 bonds for extending the electric light system and for a hot water heating plant.

Conshohocken, Pa.—An increase of indebtedness for the purpose of installing a municipal electric light, heat and power plant is being considered.

Muscatine, Ia.—Sealed bids are asked until 7:30 p. m. Nov. 1 for a 10-year public and private contract for lighting. Bert C. Benham cy, recdr.

Marion, Ind.—The merchants of this city will start a commercial lighting plant on the co-operative plan, unless the local companies reduce their prices.

Zeeland, Mich.—The Grand Rapids, Holland and Lake Michigan Electric Railway Company has asked for a franchise for establishing an electric light plant in this town.

Florence, Ala.—A franchise for an electric light, power and heating plant, and an electric street railway for this city has been granted to M. C. Buzbaum and others.

Little Rock, Ark.—The contract for improvements to the municipal electric plant was awarded to the Ft. Wayne Electrical Company of Ft. Wayne, Ind., for $19,700.

New York City.—The contract for the electrical equipment of the power house and subway stations of the Rapid Transit Company was awarded Oct. 4 to the Westinghouse Electric and Mfg. Company for $1,500,000.

Bloomington, Ind.—The city council has threatened to revoke the franchise of the People's Electric Light Company because that company refuses to improve the service. The franchise was granted about six months ago.

The question of issuing electric light bonds will be voted on at the following places: Mascoutah, Ill.; Mexico, Mo.; Nov. Newell, Ia., Nov. 4; Delphos, O., Nov. 5; Hubbard, O., Nov. 5; Wellington, Kas., Nov. 5; Newbern N. C., Dec. 3.

The construction of electric light plants is contemplated at the following places: Franklinton, N. C.; Highland, Ill.; Dexter, N. Y.; Odell, Ill.; Atkinson, Ill.; Royal Centre, Ind.; Ewan, N. J.; Heron Lake, Minn.; Jasper, Ala.; Red Lion, Pa.; Newcomerstown, O.; Encampment, Wyo.

PARKS.

Ironton, O.—The Camden Interstate Railway Company has purchased the fair grounds at this place and will convert them into a park.

Augusta, Ga.—Jacob S. Martin, landscape gardner, of Providence, R. I., has made a proposition to the council to build a park.

Canton, Ill.—"Owl's Nest," a beautiful park in the suburbs, was bequeathed to this city by Richard B. Divilbliss, who died recently.

Lewiston, Id.—(Special.)—Ernest McCullough, cy. engr., has prepared plans for a new park and is surveying for a boulevard around the hills west and north of the city.

Middlebury, Vt.—The mountain park in the towns of Warren and Lincoln, containing nearly 4,000 acres, has been purchased by Col. Joseph Battell of this city and will be converted into a park. It will be called "Ellen's Mountain."

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Springfield, O.—A garbage crematory will be built next year.

Spokane, Wash.—The purchase of a crematory site has been authorized.

Findlay, O.—The question of building a garbage crematory is being revived.

Meadville, Pa.—The purchase of suitable land for a garbage crematory has been decided upon.

Great Falls, Mont.—A new Studebaker sprinkling wagon of 750 gals. capacity has been purchased by this city.

Lowell, Mass.—The contract for constructing a crematory has been awarded to the Bridgeport Boiler Works for $25,000.

Los Angeles, Cal.—The Board of Public Works decided Oct. 11 to recommend several miles of streets to be sprinkled with oil.

East Liverpool, O.—The board of health has voted to recommend the immediate construction of a garbage crematory at a cost of about $12,000.

Hamilton, O.—The contract for constructing a garbage crematory has been awarded

the Dixon Garbage Crematory Company of Toledo, O., for $11,270.

Dallas, Tex.—The city officials desire information relative to garbage disposal plants. Data secured so far has proved unsatisfactory. Ben. E. Cabel, mayor.

New Brunswick, N. J.—The question of building a garbage crematory is being considered by committees from the board of health, board of aldermen and citizens.

Wilmerding, Pa.—An ordinance has been passed granting the exclusive right of removing all garbage to Jas. L. Waddell for a period of 10 years. The ordinance provides that Mr. Waddell shall erect a garbage furnace at some point within the borough limits.

Canton, O.—Sealed bids are asked until Nov. 16 for garbage disposal works, including a building, garbage furnace or crematory, with smokestack, etc. The garbage furnace is to be constructed in two separate parts so that one can be operated independent of the other. C. C. Lloyd, cy. clk.

Philadelphia, Pa.—The estimate of the street cleaning bureau for next year is $1,071,320, the principal items of which are: Five hundred and fifty thousand dollars for removal of ashes and house waste, $46,000 for cleaning alleys and undedicated paved streets, $442,000 for removal of garbage and dead animals. Specifications for cleaning the streets and removing garbage next year are now in the hands of Director of Public Works Haddock and local press reports state that bids will soon be asked.

TOO LATE FOR CLASSIFICATION

Natchez, Miss.—The purchase of the water works plant is urged by the press.

Springfield, Ill.—The property-owners on S. Eleventh-st. want that street paved. Mayor Phillips.

Sisseton, S. D.—The citizens are agitating the question of building an electric light plant.

Cresco, Ia.—An ordinance has been passed for building sidewalks on Elm-st. S. S. Culver, mayor.

Hempstead (L. I.), N. Y.—A franchise for lighting the streets was granted to the Roslyn Light and Power Company.

St. Louis, Mo.—Ordinances are being prepared for establishing two boulevards and three joint sewers.

Moline, Ill.—Asphalt paving is proposed for Twenty-third-st., from Third to Seventh-ave., next season. Mayor Wessel.

Jacksonville, Fla.—A petition has been circulated for paving Treasury-st., between St. George and Charlotte-sts., with brick.

Youngstown, O.—A franchise has been granted Charles D. Hauk for supplying the citizens with manufactured and natural gas.

Swissvale, Pa.—Bids are asked until Nov. 2 for grading Lewis-st., between Braddock-ave. and the borough of Edgewood, 3,400 cu. yds.

Sterling, Ill.—An 8-foot cement walk has been ordered built at the side of the C. Cruse building; also 50 feet of cement walk on W. Fourth-st.

Allegheny, Pa.—Councils began a movement Oct. 21 for building a water reservoir of 600,000,000 gallons for increasing the supply.

Newark, N. J.—Ordinances have been passed providing for pipe sewers on S. Nineteenth and Brenner-sts. Wm. E. Greathead, prest. bd. water com'rs.

Chicago, Ill.—A proposition has been made to the South Side branch of special parks commission providing for a chain of lakes in Auburn Park.

Santiago de Cuba.—The contract for constructing sewers has been awarded to Michael J. Dady of Brooklyn. N. Y., according to press reports.

Kansas City, Mo.—Sealed bids are asked until 11 a. m. Nov. 6 for constructing curbing and granitoid walks on certain streets. Robt. W. Waddell, cy. engr.

Morgantown, W. Va.—Gilmore & Snyder have sub-let the contract for paving the streets of South Morgantown to Dean & Hoffman of Niagara Falls, N. Y.

Wilkesbarre, Pa.—The contract for street lighting was awarded Oct. 22 to the Wyoming Valley Electric Light, Heat and Power Company for 5 years at $65 per lamp.

Connersville, Ind.—The contract for building cement walks was awarded to E. S. Griffith at 15 cts. a sq. ft, 50 cts. a lin. ft. for curbing, and 35 cts. for gutter.

Baltimore, Md.—All legal obstacles to the installation of an electric light plant for Daniel Hill Park have been removed. The Westinghouse Company has the contract.

Marshalltown, Ia.—A resolution has been adopted to purchase two Morris pumps for the disposal plant and charge the cost to the St. Louis Electrical Supply Company, which has the contract for the power plant.

Washington, D. C.—The district commissioners will include in their estimates to Congress an item for $500,000 for the establishment of an independent water service for the business section of the city.

Toledo, O.—Engineer Wickham contemplates building a mile of driveway on the boulevard with gravel and a mile with broken stone. He is of the opinion that he can then determine by spring which is the better material to use.

Michigan City, Ind.—The contract for paving Seventh-st. with macadam was awarded Oct. 21 to A. Runyan & Co. at 34 cts. a lin. ft. for curb, 22 cts. a cu. yd. for grading and 65 cts. a sq.yd.formacadam. The contract for brick paving on Barker-ave. was awarded to W. H. Bell & Co., of Chicago, at 26 cts. for curbing, 15 cts. for grading and $1.26 for paving.

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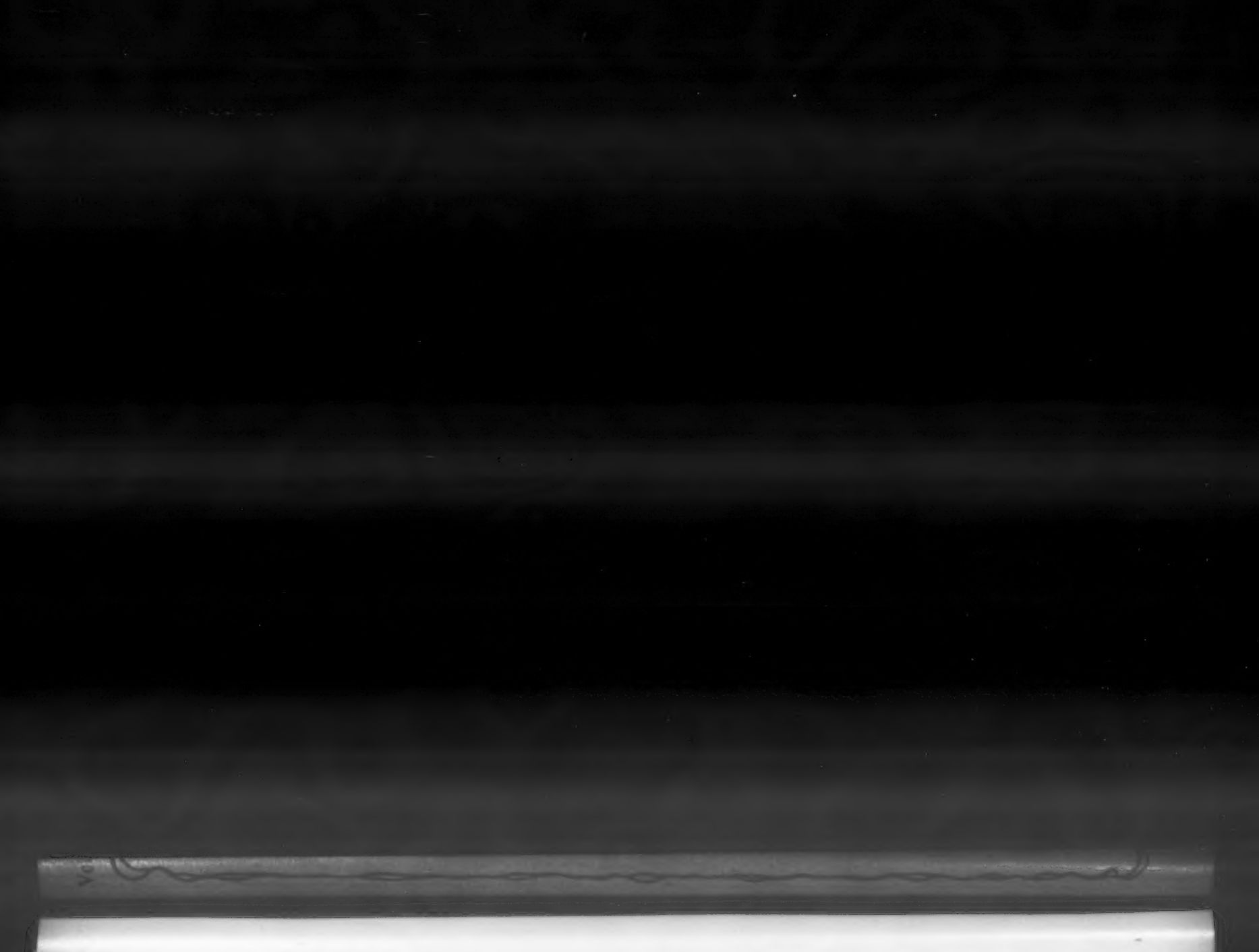
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